FACTORY

MANAGEMENT AND MAINTENANCE

A McGRAW-HILL PUBLICATION

FEBRUARY 1944

Rehabilitation of Veterans... page 82

ENGINEERS SPECIFY "SHERARDUCT" RIGID STEEL CONDUIT

- Sherasolution which impregnates zinc
- Surface zinc over the alloy may be as thick as desired
- Alloy composed of surface steel and zinc making a new metal, zinc-steel alloy
- "Premium" steel costing more per ton than ordinary merchant pipe

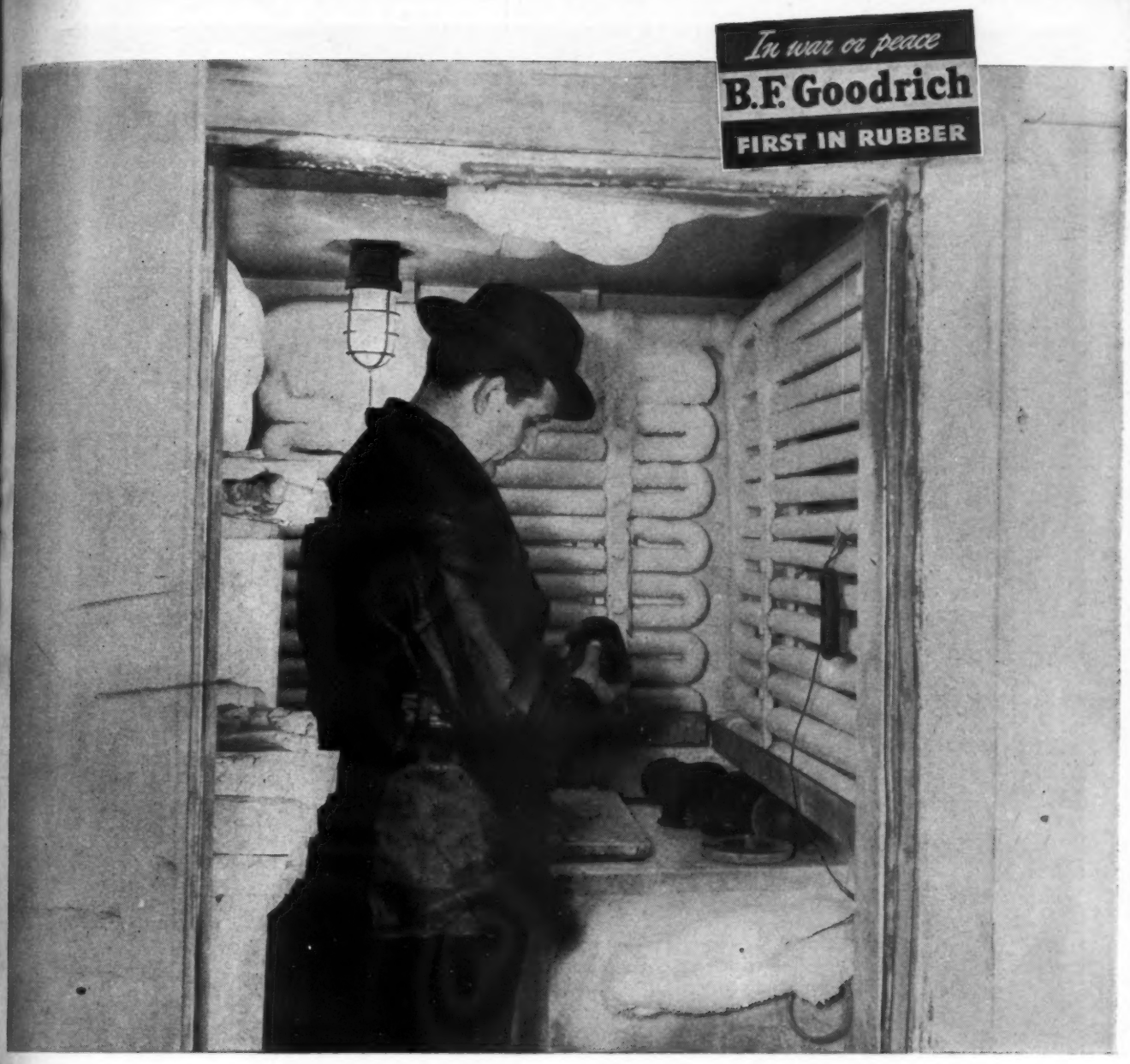
Sherarduct

* Threads as well as interior have equal protection with the outer wall of the conduit.

National Electric

Products Corporation

Pittsburgh, Pa.



The ice-box that moved Alaska to Akron

A typical example of B. F. Goodrich development in rubber

THERE'S no point in sending our planes to Alaska if they won't work after they get there—and most of the early ones didn't. For example, bomb bay doors, gun turrets, brakes and shock absorbers are often operated by hydraulic power. They depend on the rubber rings which seal the 1500 to 3000 pounds of pressure in the hydraulic cylinder. It used to be that rings of hard rubber were used to resist the oil in the hydraulic system. But they became brittle, shrank, cracked at low temperatures. Pressure was lost, controls slowed down—or didn't work at all. The lives and safety of flyers and planes were being risked because of the failure of little rubber rings.

Before the war B. F. Goodrich engineers had developed a synthetic rubber that, unlike natural rubber, was resistant to oil. But compounding it to stay flexible in Alaskan temperatures of 65 below was another problem. Experiments got under way. New compounds were tested, first in the cold room in the picture, then in Alaska. B. F. Goodrich research men succeeded in making a compound that wouldn't get hard, wouldn't crack, wouldn't shrink at 65 below. In Alaska—seals made of this material resisted hydraulic oils, outwore hard rubber many times and stayed flexible—on the job in the worst weather. Today these hydraulic seals are in use all over the world.

B. F. Goodrich research never stops. It has solved hundreds of wartime problems, gone into millions of products for war and industry. When the war is won it will again be devoted to better products for peace. *The B. F. Goodrich Co., Industrial Products Div., Akron, Ohio.*

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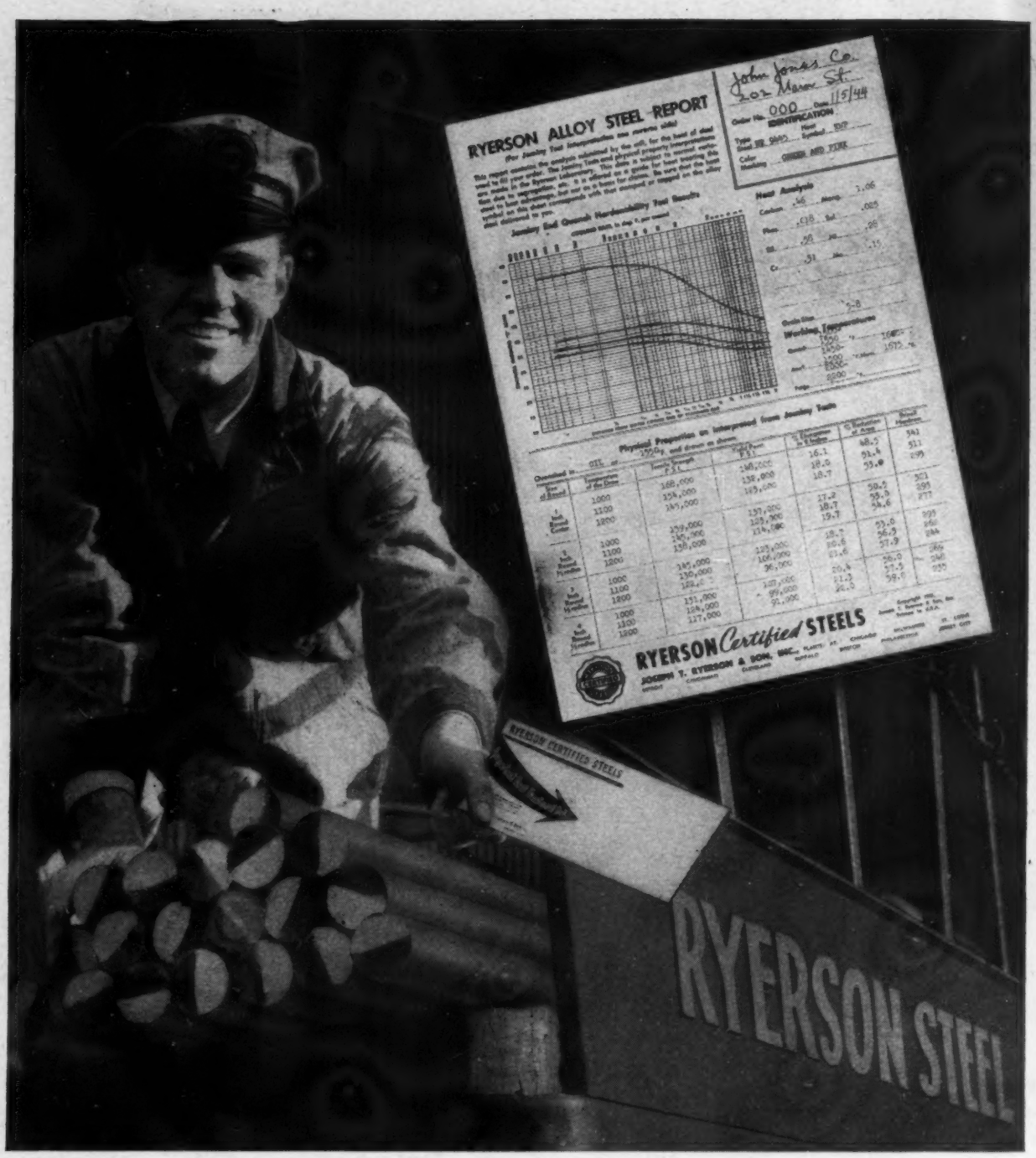
RUBBER *and* SYNTHETIC *products*



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Again, on this month's cover, FACTORY pays tribute to the hundreds of thousands of women who have signed up in industry for the duration, thereby helping management solve its acute manpower problems. Kodachrome taken at The Heil Company, Milwaukee. Made available by Office of War Information.

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FACTORY

MANAGEMENT AND MAINTENANCE

FEBRUARY · 1944

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Scratches are fatal because they mean rejections! In the case of bronze bearings and bushings for important war-time requirements, scratches occurred when these items came in contact with each other during various phases of production and shipment. The answer? An H & D war-time packaging development that provides positive product protection throughout the entire production and shipping cycle.

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Fluorescent operating hints

No. 1 of a series published by Sylvania for all users of fluorescent lighting.

HOW TO TEST LAMPS AND STARTERS

If a fluorescent lamp blinks or fails to light early in life, it does not necessarily indicate premature lamp failure. The trouble may be a defective ballast or a faulty starter. However, the first thing to do is to replace both the lamp and the starter with units known to be satisfactory. If the new lamp fails to operate with the new starter in place, loose connections in the wiring or ballast may be the reason, and the electrician should check the entire circuit.

To check the questionable lamp and starter that have been removed, test them in a fixture known to be performing properly, or return them to the maintenance shop for checking on a simply constructed test board.

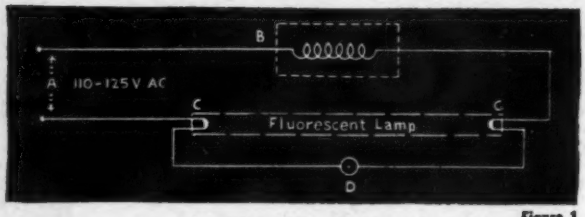


Figure 1

HOW TO MAKE TEST BOARD

Fig. 1 shows the wiring for a simple test board that can be used to check either lamps or starters. *A* is the connection to the 110-125 volt AC line. *B* is a single-lamp ballast of the same wattage rating as the lamp being tested in *C*, the lamp sockets. *D* is the starter socket.

Fig. 2

DUMMY-STARTER TESTER

For use with this test board, you can make a dummy-starter tester from a spare or used Sylvania starter by removing the can and connecting the two contacts permanently, Fig. 2. Replace the can and scratch it with a distinctive mark, so that it will not be mistaken for one of your regular starters.

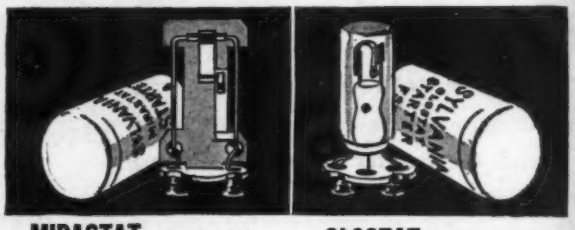
TESTING THE LAMP

Place the lamp to be tested in lamp sockets *C*, and place the dummy starter in socket *D*. If the lamp is good, both ends of it will glow when the dummy starter is in the socket; and the entire lamp will light when the dummy starter is *quickly* removed. If the lamp does not perform in this way, it is worn out and should be discarded.

HOW TO TEST STARTER

To test starters on the test board, put a lamp known to be good in sockets *C*, and put the questionable starter in socket *D*. If the starter is good, the lamp will light in less than 30 seconds.

(*CAUTION*: Test No. 2 starters with 15- or 20-watt lamps only; No. 4 starters with 30- or 40-watt lamps only; No. 5 starters with 6- and 8-watt lamps only; No. 6 starters with 100-watt lamps only; and No. 7 starters with 65-watt lamps only.)



MIRASTAT—Sylvania's thermal-type starter

GLOSTAT—Sylvania's glow-type starter

STARTERS ARE LAMP-LIFE INSURANCE

The fluorescent lamp starter is an automatic time-delay switch. Mechanically rugged, it enables the fluorescent lamp to establish its lighting arc without the use of high voltage.

Starters cost only a few cents — but they protect your really important investment in fluorescent fixtures and fluorescent lamps. Defective starters shorten lamp life and cause overheating in ballasts. It pays to test your starters and replace defective ones with Sylvania Mirastats or Glostats.

For Additional Maintenance Information

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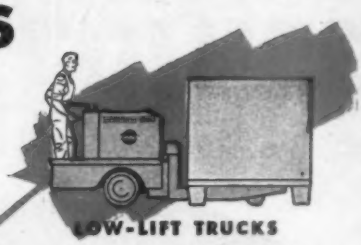
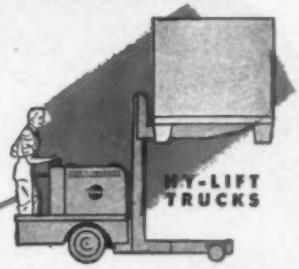
NEW Baker Truck Catalog GIVES THE ANSWERS TO YOUR MATERIAL HANDLING PROBLEMS

Here's real help for any plant or warehouse faced with transportation problems. The Baker Electric Truck Catalog No. 52 is more than a catalog. It is a handbook of information on material handling with power trucks, designed to facilitate selection of the proper equipment for any set of requirements. In addition to describing the 47 standard Baker Electric Trucks, it covers many special models designed for unusual handling operations.





Actual case histories featured throughout the book show Baker Trucks of all types speeding production, saving time and money and conserving man-power in a wide variety of installations. You are almost sure to find problems comparable to those in your plant, and you can profit from the experience of others in solving them.

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find this book a valuable source of information. Write for your copy of The Baker Electric Truck Catalog No. 52 today.

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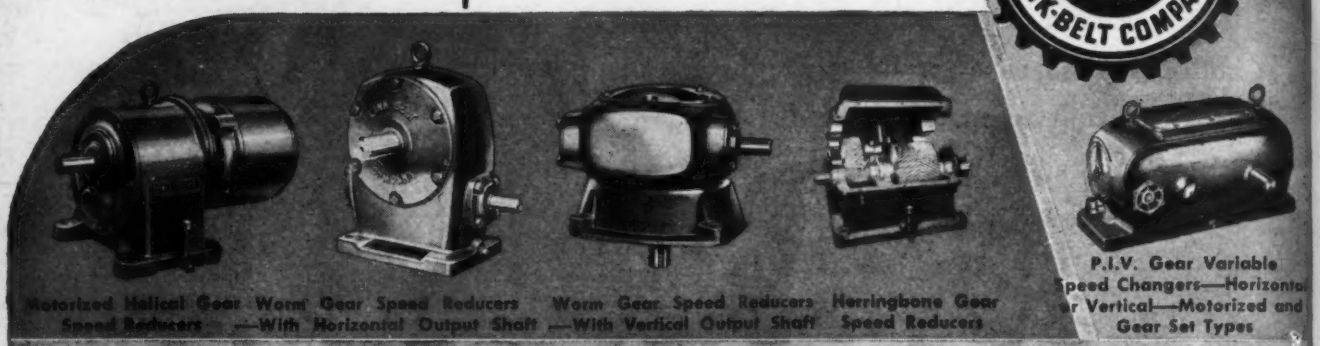

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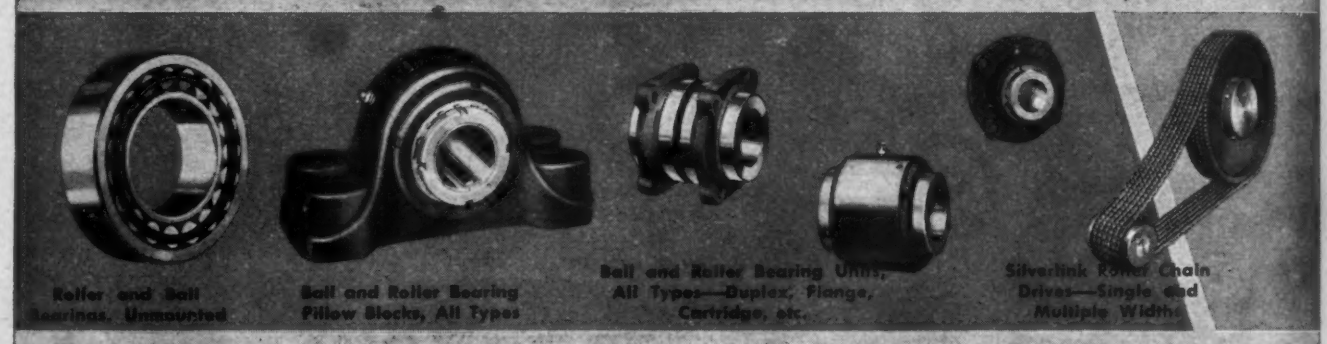

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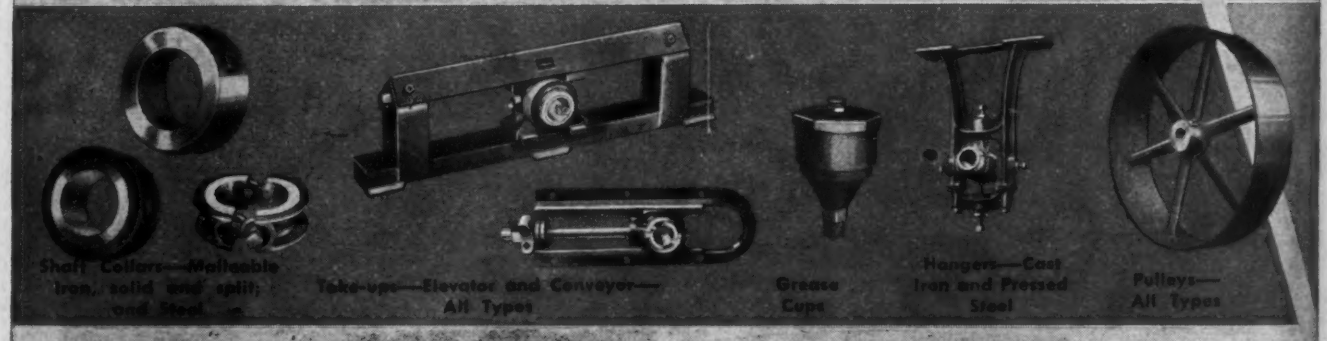

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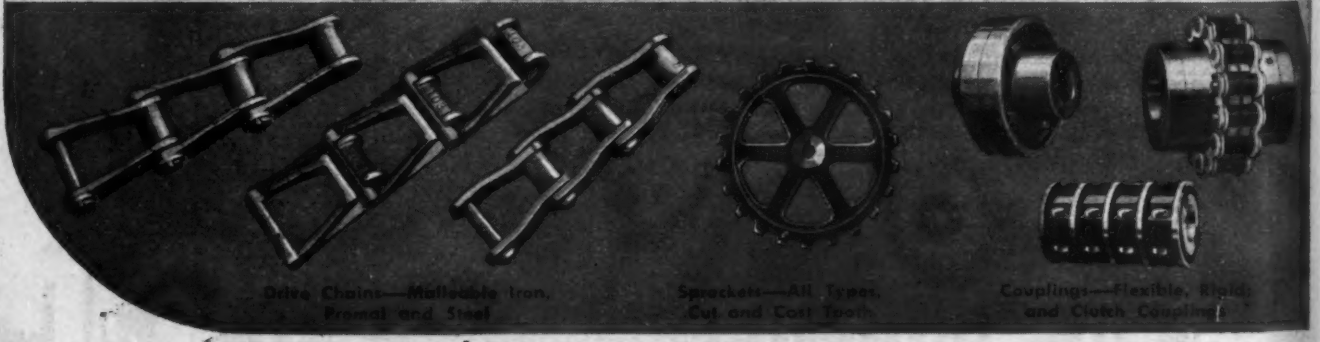

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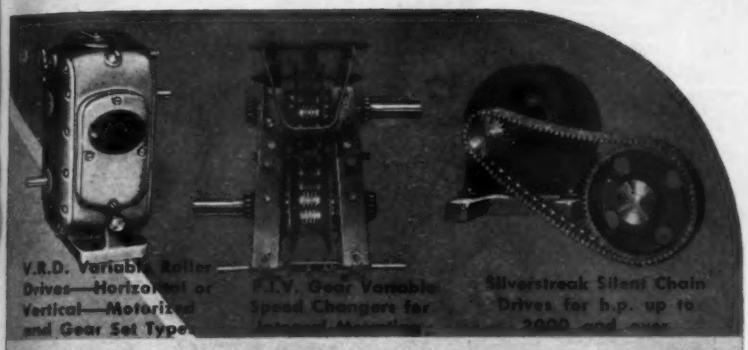

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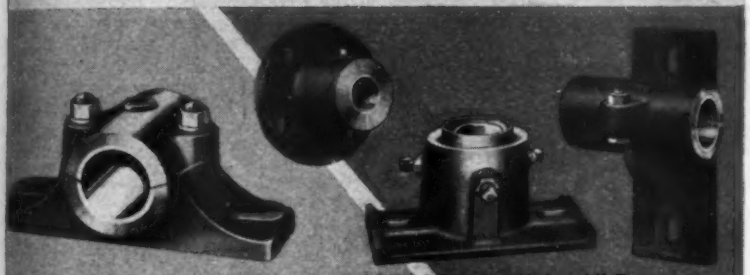

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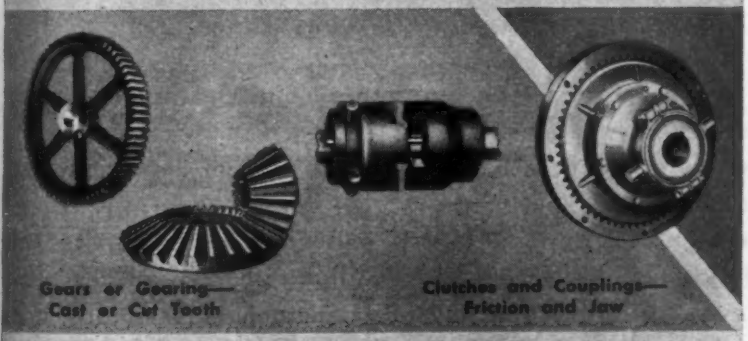
Babbitted Bearing Units, All Types—Flange, Step, Post, etc.



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. . THROUGH GLASS

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For example, it is now possible to obtain glass that will withstand violent temperature changes; colored glass amazingly uniform in hue and transmission properties; glass extremely strong and tough; glass that transmits only selected portions of the spectrum in both the visible and invisible areas.

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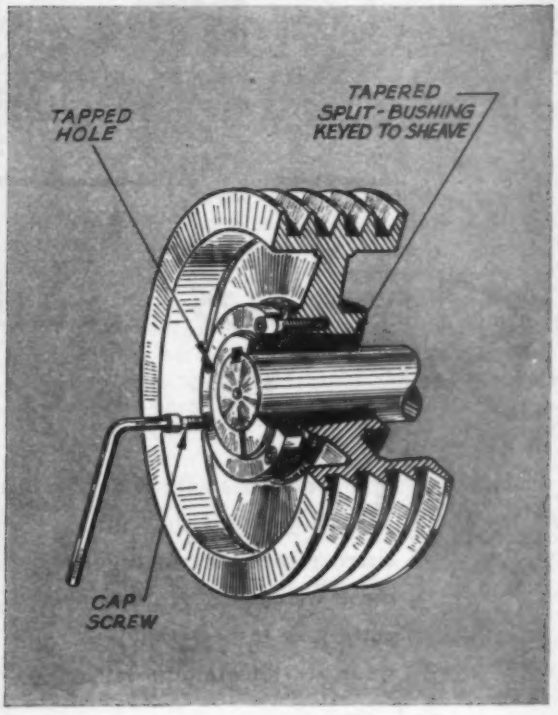
Three cap screws, 1 small wrench, are all it takes to lock "Magic-Grip" sheave uniformly on shaft . . . creating a positive clamp fit.



We call it "Magic-Grip" because in just one quick operation sheave locks securely to shaft, saving man-hours and downtime!

DESIGNED for ease and speed in mounting and removing, Allis-Chalmers' great new "Magic-Grip" is the fastest mounting sheave on the market. Its tapered split bushing locks sheave to shaft in a single operation . . . *without forcing.*

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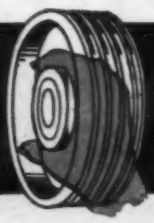
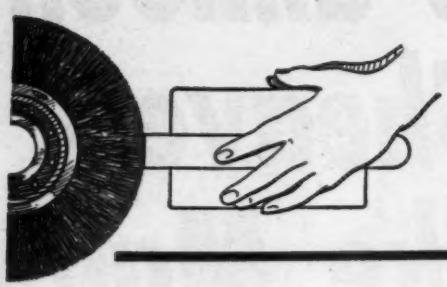
"MAGIC-GRIP"  SHEAVES



Right Speed

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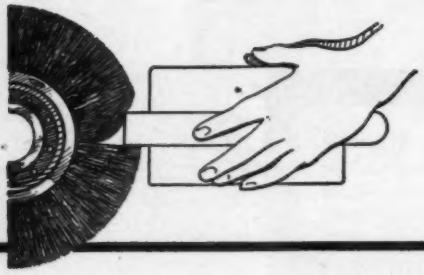

Wrong Speed

Sometimes ... the slower the speed the faster the brush wears out

IT'S only the wire *ends* of a brushing tool that do the cutting work. At correct speed, centrifugal force holds these wire ends against the work . . . cutting is fast, wire fatigue and brush wear at a minimum.

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Osborn Brushes

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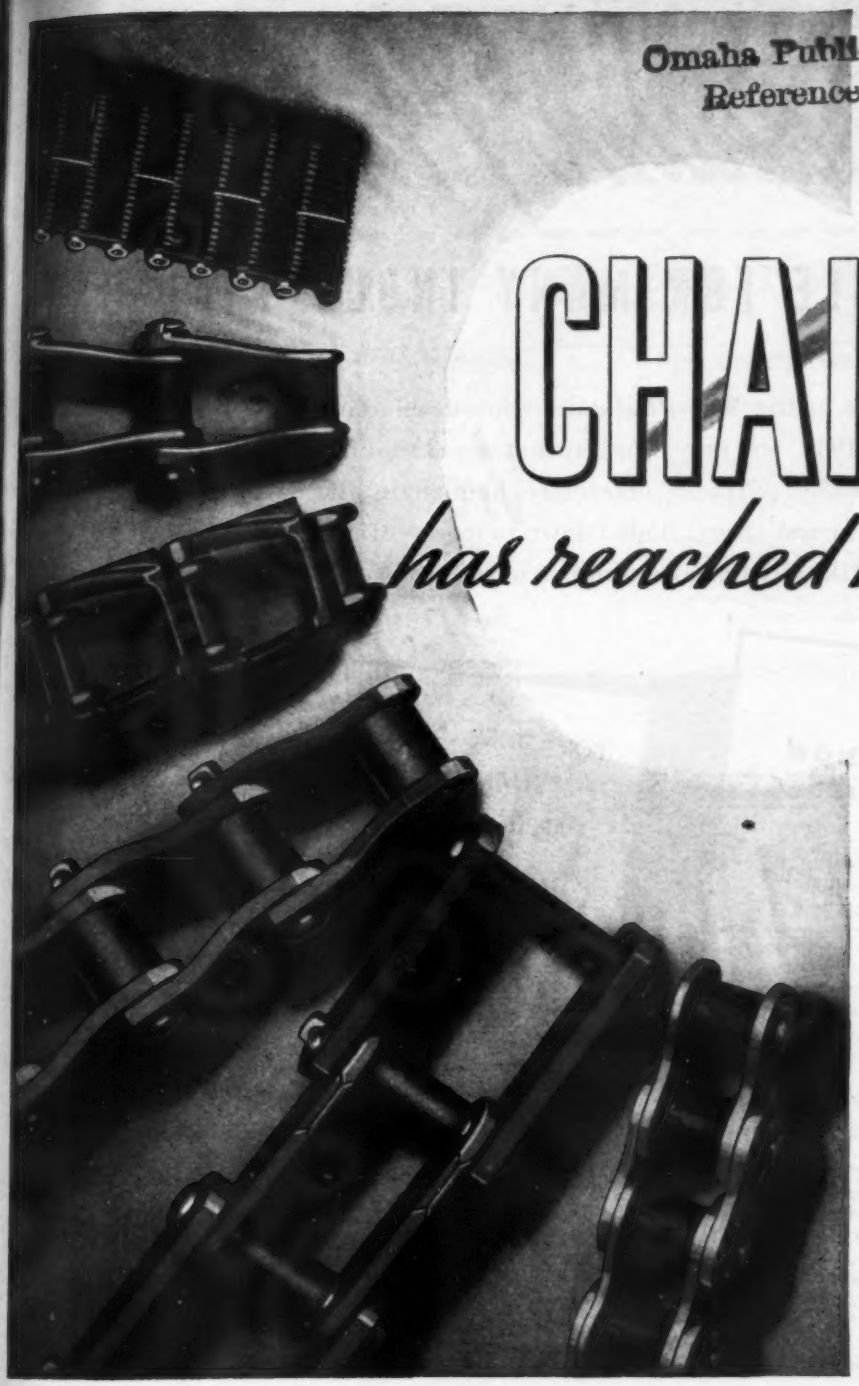


CHAIN *too,*

has reached new ceilings!

• Flying and fighting seven miles up, the modern war plane, capturing our fascinated wonder, is the symbol and the result of vast developments in every sphere of science and industry. In that plane, as in the plant that built it, and throughout industry today, power is produced, applied and controlled more efficiently because of continuing and accelerated engineering progress.

Chains used today for aircraft controls, for tanks, trucks, jeeps and other motive equipment, for conveying and mechanical power transmission throughout industry, have been vastly improved to meet today's exacting demands. Link-Belt engineers and metallurgists have perfected lighter, stronger, more precisely built chains of every type, answering, even anticipating, the needs of our production and fighting forces. Now, more than ever, Link-Belt is the recognized source for chain, and for the engineering service to aid in utilizing these newer, better chains to the great advantage of all industry.

Consult Link-Belt on any problem relating to mechanical power transmission, materials handling or conveying. You are assured of reliable, unbiased recommendations and of efficient, economical equipment.

LINK-BELT COMPANY

The Leading Manufacturer of Materials Handling and Power Transmission Machinery

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices, warehouses and distributors in principal cities.

5378-A

Chicago Plants · Indianapolis Plant · Ordnance Plant

LINK-BELT

CHAINS AND SPROCKETS

for conveyors • for drives • for power transmission

Aluminum Paint

IS AGAIN AVAILABLE FOR MANY INDUSTRIAL USES

By an order of the War Production Board, effective January 1, 1944, you may now buy and use aluminum paint for many purposes heretofore banned in the interest of the war effort. Boiled down to its essentials, here is what the order means to industrial users of paint:

OK WPB — THESE USES NOW UNRESTRICTED

With an AA-5 (or higher) rating on your order, you can buy aluminum paint for the following manufacturing, maintenance, repair and construction operations:

1. Combat products for the Army, Navy, Maritime Commission, War Shipping Administration or Lease-Lend.
2. Ship engine rooms and equipment.
3. Trainer, civilian and commercial aircraft.
4. Sealing bituminous coated surfaces.
5. Interior use in industrial plants and for industrial equipment where excessive moisture, fumes or temperatures prevail.
6. Interior surfaces in dairies, milk bottling plants and food processing plants.
7. Outdoor storage tanks for petroleum products and volatile chemicals.

FOR OTHER USES, MAKE APPLICATION

W.P.B. WASHINGTON D.C.

For uses other than those specifically approved, you are required to make application to WPB, Aluminum & Magnesium Section, Washington, D. C., Ref. M-1-g. Special consideration is promised where it can be shown that aluminum paint is more advantageous than less critical material. Your application must set forth the following:

1. Quantity of aluminum paint or aluminum pigment required.
2. Type of equipment or surface to be painted.
3. Reasons why aluminum paint is required for the purpose.
4. Rating which you are entitled to put on your order.
5. Supplier from whom you will get your paint.

If you have any questions as to how the WPB order fits your particular case, or if you wish to have a copy of the official order, M-1-g, write ALUMINUM COMPANY OF AMERICA, 1983 Gulf Building, Pittsburgh, Pennsylvania.

7 ADVANTAGES OF ALUMINUM PAINT

- High durability
- High reflectivity
- High hiding power
- Resistance to moisture
- Resistance to fumes
- Resistance to heat
- Attractive appearance

ALCOA ALUMINUM

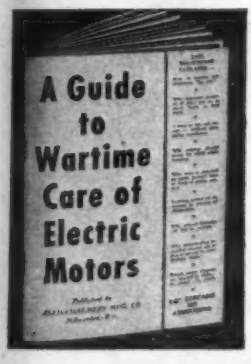
Alcoa Albron Pigments are made under patents of the Metals Disintegrating Company, Inc.

ALBRON ALUMINUM PAINT

FIRST AID FOR MOTORS

MOTORS RUN A FEVER? No wonder if they do more often today. They're working *3 and ½ times* as many hours as in peace!

Wartime conditions demand you diagnose motor ailments *quickly* ... remedy the trouble at once. At right are but few of the many diagnoses found in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors". In maintenance as in war, *attack is the best defense*. This book singles out the 9 main enemies of electric motors . . . tells you how to get them *before* they get your motors!



Over 100,000 copies already in use.

Write today for your *free* copy. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

SYMPTOMS YOU CAN SEE

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon . . . and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.
7. Brush "chatter."	Extreme vibration.	See item 10, below.

SYMPTOMS YOU CAN FEEL

8. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine.	Eliminate source in machine, if possible. Or a flexible belt drive may be in order.
9. Motor overheating. (Check with thermometer—don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.
	Dirt in motor. Check flow of air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubs stator.	Replace bearings.

A 1638

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

A-C WE WORK FOR VICTORY WE PLAN FOR PEACE

is it possible to build a rat?

IN the answer to this extraordinary question is a curious story. For two scientists once posed that very question to themselves . . . and the answer was Yes!

They actually built a machine with the power to "learn" by experience and "remember" what it had learned—a mechanism capable of simulating the rudimentary behavior of a rat. Comprised of solenoids, gears and relays, it traveled a grooved track forked by 12 dead-end side-tracks—equivalent to the blind alleys which a living rat encounters. Set to take the dead-end forks, as if by an inner compulsion, this robot rat literally learned by experience to avoid the frustrating blind alleys, in a perfect mechanical analogue to the conditioned reflexes of the brain.*

To build a machine that would reproduce *all* the behavior of a rat "would require a mechanism probably as large as the Capitol at Washington"—*but it could be done!*

For we're at the beginning of an amazing new technological age. Already there are many kinds of thinking machines in our incredibly mechanized world, helping to speed production, cut costs and build better products. And intimately a part of this whole story is the science of machine tool engineering.

Today, Jones & Lamson engineers are working with the leading manufacturers in virtually every industry, helping them to plan production *now* for the machines and the products of tomorrow.

They are at your service, too.

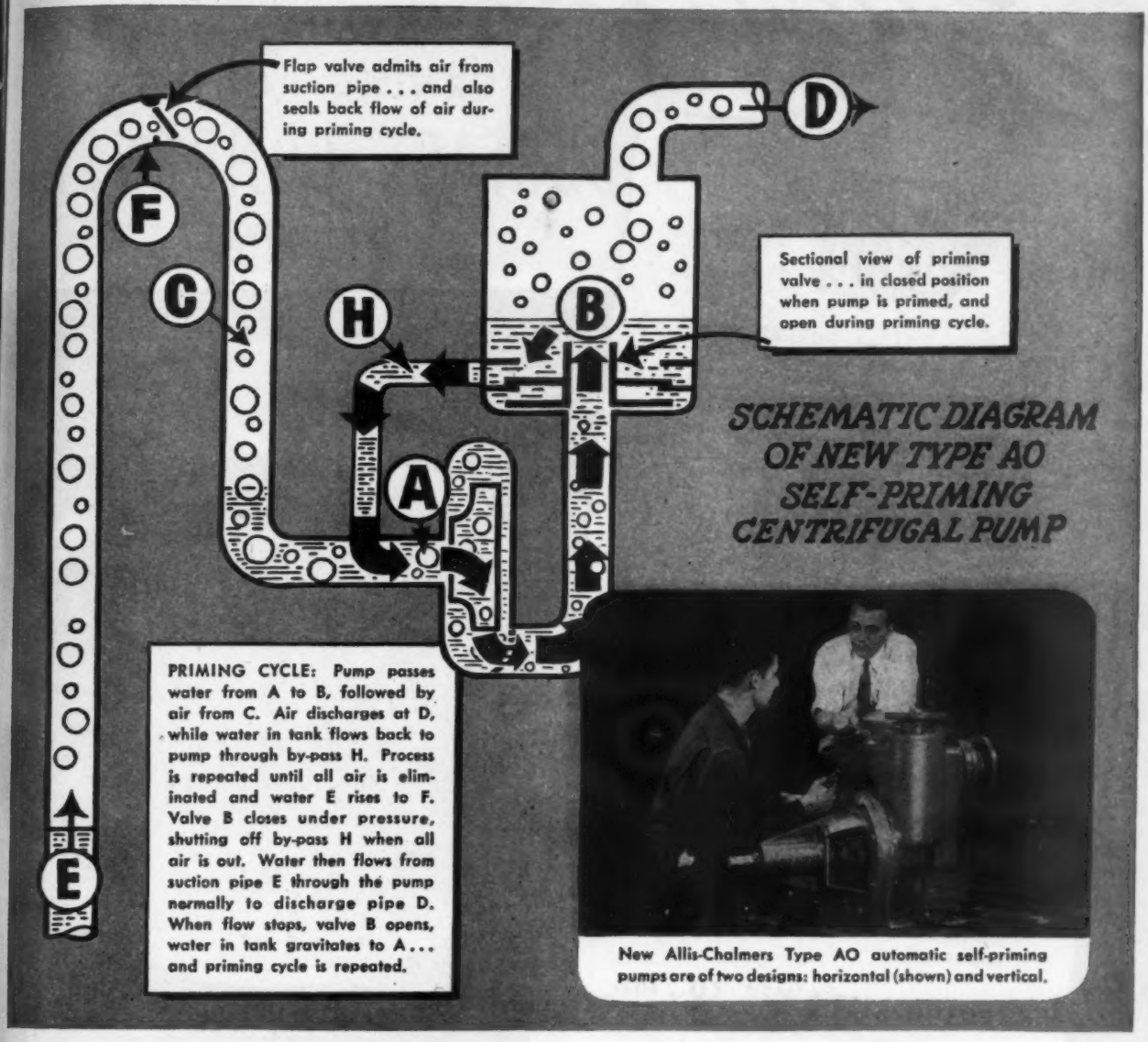
* *In "The Advancing Front of Science" by George W. Gray, a memorable chapter on thinking machines reports this story in full.*

JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

Profit-producing Machine Tools

PRODUCT OF THE MONTH


Flap valve admits air from suction pipe . . . and also seals back flow of air during priming cycle.
Sectional view of priming valve . . . in closed position when pump is primed, and open during priming cycle.
SCHEMATIC DIAGRAM OF NEW TYPE AO SELF-PRIMING CENTRIFUGAL PUMP
PRIMING CYCLE: Pump passes water from A to B, followed by air from C. Air discharges at D, while water in tank flows back to pump through by-pass H. Process is repeated until all air is eliminated and water E rises to F. Valve B closes under pressure, shutting off by-pass H when all air is out. Water then flows from suction pipe E through the pump normally to discharge pipe D. When flow stops, valve B opens, water in tank gravitates to A . . . and priming cycle is repeated.
New Allis-Chalmers Type AO automatic self-priming pumps are of two designs: horizontal (shown) and vertical.

MILWAUKEE, WIS.—Allis-Chalmers announces a new automatic self-priming centrifugal pump, Type AO, which insures high efficiency through use of a new-type spring valve. The AO is especially adaptable to applications where speed of installation is important. Available for high priority jobs. A 1668

WE WORK FOR VICTORY · WE PLAN FOR PEACE
ALLIS-CHALMERS · MILWAUKEE · WISCONSIN

Balanced Flow

WAS A TURNING POINT IN SURFACE CONDENSER DESIGN

ROSS

When Ross introduced Balanced Steam Flow, by means of split tube support plates, it was a great turning point in Surface Condenser design. For the first time, a simplified system for equalized pressure through the bundle was achieved, embodying these outstanding features:

★ Congestion at entrance to a cool section relieved

★ Pressure loss across any portion of the bundle reduced to a minimum

★ Practically uniform pressure drop for all paths through the main tube banks

★ Entire surface able to condense steam actively with the maximum possible temperature difference

Because of these outstanding advantages, more and more condenser manufacturers are turning to split tube support plate construction.

So, again an early Ross discovery (introduced simultaneously with Ross divided tube banks) has influenced the trend of modern Surface Condenser design . . . another "First" accounting for Ross leadership today!

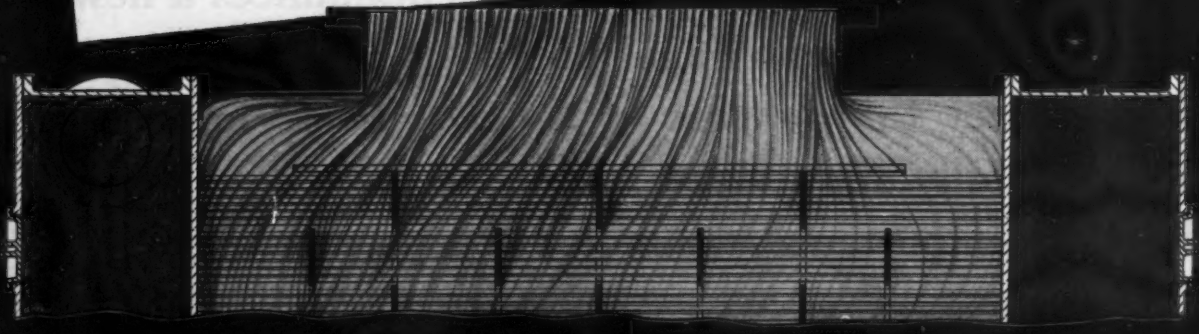
ROSS HEATER & MFG. CO., Inc.

Division of American Radiator and "Standard" Sanitary Corporation

GENERAL OFFICES & PLANT

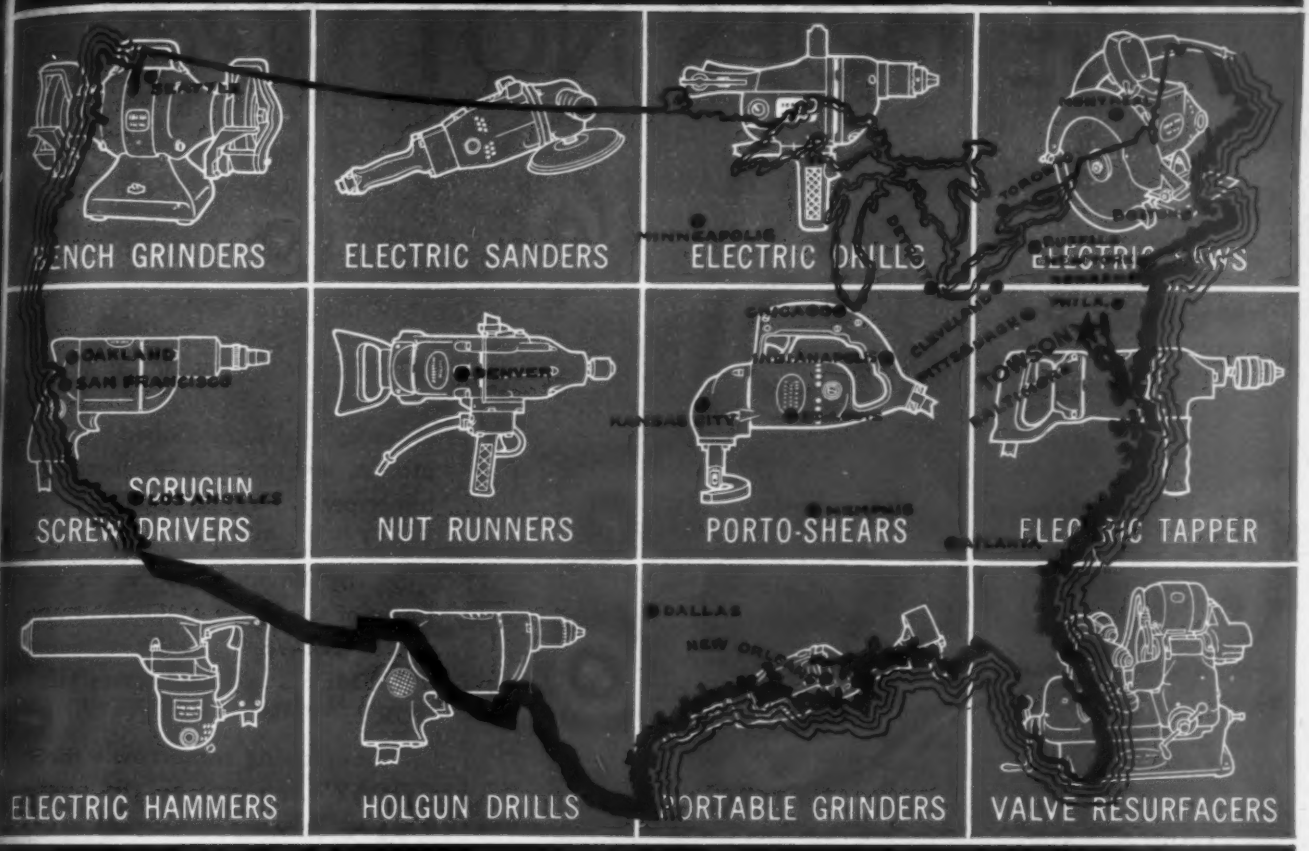
1427 WEST AVENUE BUFFALO 13, N. Y.

Divided and Offset Tube Support Plates, Condensate Trays and Air Cooler Shells.



Balancing Flow within the Tube Bundle

ALL OVER THE MAP!



Quick Repair Service on Van Dorn Tools at 26 Factory Branches

Van Dorn Portable Electric Tools have abundant power, a record of long usefulness, and are backed by quick service on repairs and parts if and when you need it. In the 26 cities shown on the map are Van Dorn Factory Service Branches, stocked with genuine Van Dorn parts, where factory trained men give you quick service on repairs or parts for Van Dorn Tools.

Wherever you are, one of these Van Dorn Branches is never more than 24 hours away—ready to service your Van Dorn Tools promptly, efficiently, economically. That's another reason why, in so many plants, it's standard practice to "Specify Van Dorn." Get the habit. For Powerful Electric Tools, for help on any tooling problem, get in touch with your nearby Van Dorn Jobber. The Van Dorn Electric Tool Co., 719 Joppa Road, Towson-4, Maryland.

"Van Dorn"

(DIV. OF BLACK & DECKER MFG. CO.)

PORTABLE ELECTRIC TOOLS

— then he said to himself

"TIME DOES NOT WAIT"

"THE foe cannot be beaten," says Joseph Stalin, "if his forces of today, fully developed to the utmost, are opposed by forces of tomorrow . . . TIME DOES NOT WAIT."

So, by having recourse to the forces of tomorrow TODAY . . . he makes NEWS . . . he achieves TRIUMPHS . . . he dictates HISTORY.

"Developing tomorrow's force TODAY" can well be the motto hanging in every conference room where factory committees are discussing postwar procedures.

And under that motto these words: "Our ship, tank, plane, weapon industries are TODAY working with tomorrow's greatest forces for production. Come re-conversion to peacetime products, they are in practiced strategy to outproduce and underprice all competitors who have the temerity to go into postwar production with day-before-yesterday's techniques."

"Even if you had the time—don't wait for time."

"TIME DOES NOT WAIT"... he says

Look, Mr. Stalin, how through *recourse to Arc Welding* you can tweak time's forelock.

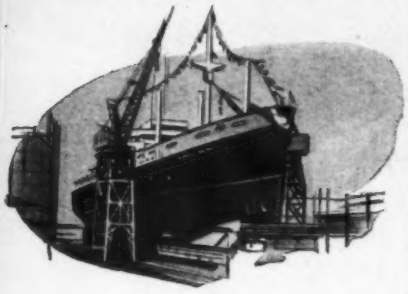
Similar time savings gave you tomorrow's force today.

Arc Welding, of course, will not win the war for you . . . but lack of Arc Welding could have lost it for you.

And that thought might well be another motto for each postwar planning room.

Omaha Public Library
Reference Room

DAYS instead of MONTHS



Easily the margin between Victory and defeat—for you and the United Nations—is putting ships on the water *6 times faster*.

LAST WAR "Liberty" size ship 300 DAYS
THIS WAR they average under 50 DAYS

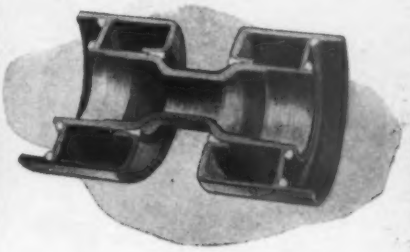
Recourse to Arc Welding in 2 years has put to work 2000 more ships than possible under old standards—thus saving the necks that Old Methods would have lost—yours and ours.

Think *that* one over!

HOURS instead of WEEKS

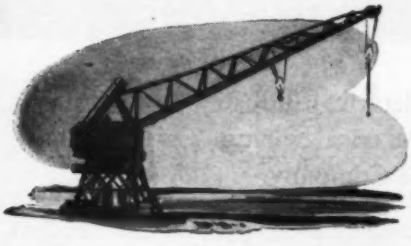
A sit-down in a steel plant lasting for weeks would be a headline SCREAM in Pravda and every newspaper in the world. That catastrophe was averted by *recourse* to Arc Welding when these six welders repaired the break of a vital steel mill part in 8 hours. Replacement would have taken weeks . . . thus sabotaging the output of a hundred war producers. Think that one over too—in terms of providing *recourse* to help in trouble.

MINUTES instead of HOURS



Half-track parts at half-time speed . . . these are typical of machine parts which *recourse* to Arc Welding helped rush to first and second fronts. Processing cost cut from $11.00 to $6.64. Machining cost cut from $3.50 to $1.25. Weight cut from 27½ to 24 lbs. Time cut 45%. This cutaway picture is to help you think over what *recourse* to Arc Welding will do to the cost of any part of any of your machines.

MINUTE-MEN of production cut MAN-HOURS on every job



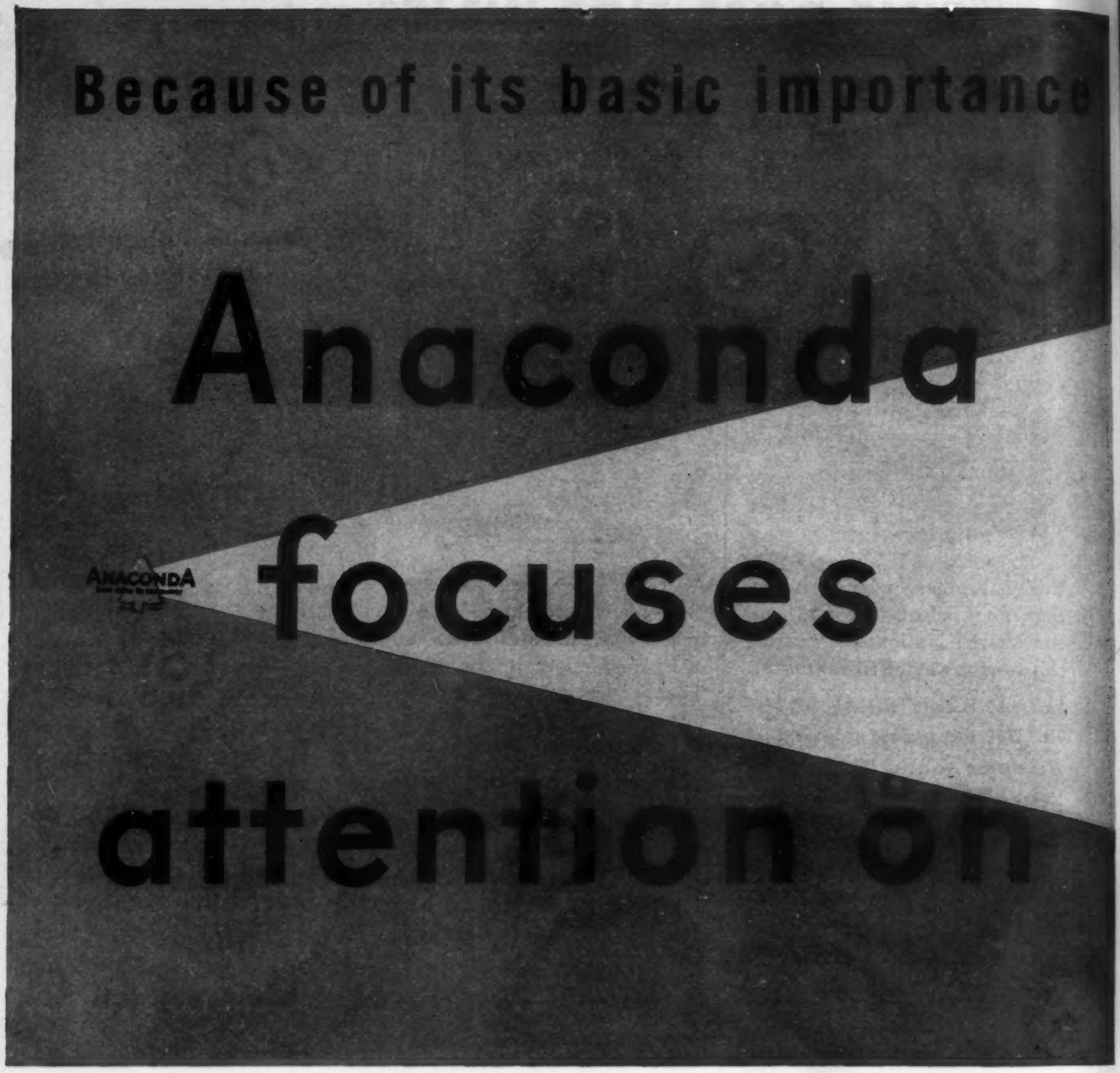
This 28-ton revolving crane which literally gives the *lift* to America's ultra-speedy shipbuilding industry—gets to the job 1,584 MAN-HOURS SOONER through *recourse* to Arc Welding.

FABRICATED . . . 23.5% FASTER
ERECTED . . . . . 21% QUICKER
than by riveted construction.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING



Nothing is more basic in furthering the interests of the electrical industry as a whole—and of each individual branch—than the promotion of electrical wiring. This has long been the number one belief with Anaconda Wire & Cable Company.

THE PAST

You probably recall the "Electrical Modernization" campaign of Anaconda prior to the war. It helped stimulate national interest in better wiring for Industry and helped to prepare Industry to meet the challenge of war production.

THE PRESENT

A more recent example is the "Preventive Maintenance" campaign developed by Anaconda engineers to meet wartime conditions. Based upon practical methods of conserving electrical circuits and equipment, it is being widely used.

Electrical Wires and Cables of Copper are the Life Lines

to the electrical industry...

PLANNED POSTWAR WIRING

THE FUTURE

Today, the time is ripe for another step forward in furthering adequate wiring. We believe we can render a constructive service to the electrical industry and to business in general through a national campaign promoting the importance of *postwar* wiring.

Its objective will be to stimulate *advance thinking* about adequate wiring...to drive home to industry, municipalities and home owners the vital necessity of including PLANNED WIRING IN EVERY POSTWAR PLAN!

THE IMPORTANCE

Obviously, more and better wiring will have to come *ahead* of tomorrow's more efficient industrial production . . . city improvements . . . new products . . . finer appliances . . . more livable homes. The wider the recognition of this, the better business for everyone . . . utility, contractor, wholesaler, manufacturer.

And now—in advance—is the time to lay the foundations. Postwar planning is gathering momentum. *Unwired* planning will benefit no one. *Planned wiring* will help everyone.

of our Nation

ANACONDA

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

How AMERICAN Hand Trucks *Save Time*

Here's how this familiar red two-wheel Hand Truck is saving time in busy war plants, warehouses and transportation terminals.

SAVES TRUCKING TIME... by taking much of the load off the men and reducing fatigue. It is accurately balanced to distribute the load and relieve dead weight. It is easier-rolling, which means FASTER trucking and more-ton-miles-per-man with less slowdown.

SAVES MAINTENANCE TIME... by being designed and built to stand up under rough wartime usage and overloading. It is practically indestructible because of modern pressed-steel construction. It stays out of the repair shop, saving time lost through breakdowns!

Today, when *saving time* means more than ever before, it will pay you to send for Catalog T-43, your guide to the best models of American Hand Trucks to meet your particular requirements. Write today.

Navy "E" for excellence awarded Feb. 12, 1942.

AMERICAN
PRESSED-STEEL
HAND TRUCKS

The American Pulley Company
4212 WISSAHICKON AVE., PHILADELPHIA 29, PA.

One million Goodyear Steel Cable V-Belts — now smashing all performance records on the toughest drives in industry and on military equipment — prove this Goodyear development to be the most efficient, longest-lived, most perfectly matched, Heavy-Duty Belt that ever turned a Multi-V drive. It handles drives no other type V-Belt will pull! Ask the G.T.M. — Goodyear Technical Man.
GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM -Specified STEEL CABLE V-BELT for Multi-V drives
1. Heavy, super-tough black cover with uniform friction, longer life
2. Load-carrying, endless, steel cables in neutral plane
3. Tension and compression sections of high-quality rubber
GOODYEAR
THE GREATEST NAME IN RUBBER
★ LET'S ALL BACK THE ATTACK—WITH WAR BONDS ★

HOW *See-ability*

RUBBER BOATS made in this plant may save American lives. The operator must cut this rubber fabric accurately and fast. See-ability, through bright, long-lasting Westinghouse Mazda Lamps, helps her do this vital job smoothly, exactly, at high speed.

Listen to John Charles Thomas, NBC, Sunday, 2:30 P. M., E. W. T.

SPEEDS PRODUCTION

Better See-ability is made possible by the efficiency and brightness of today's Westinghouse Mazda Lamps.

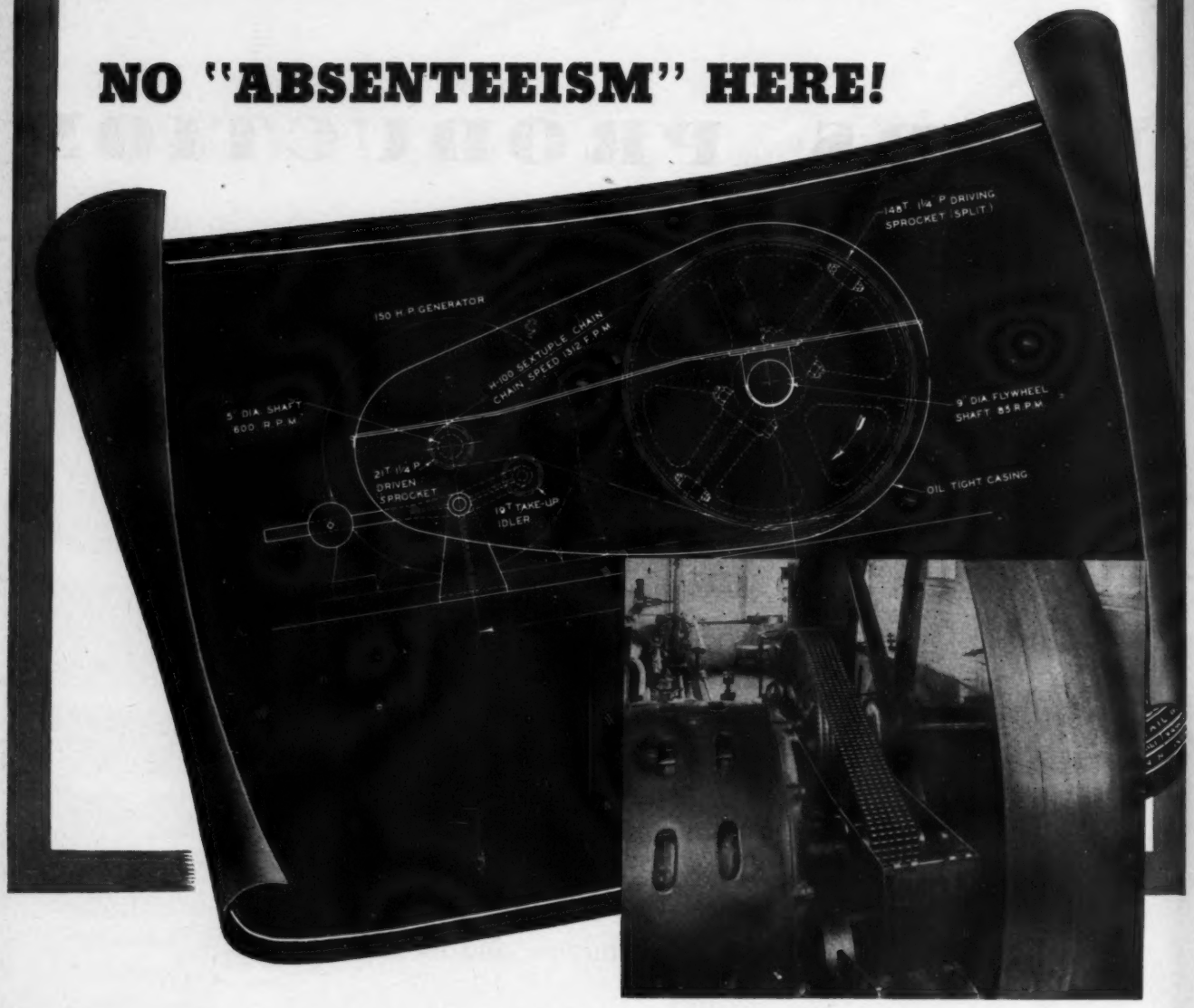
This See-ability enables the operator to work to closer limits, faster, more accurately. Under See-ability conditions, mistakes are fewer, accidents reduced, materials saved, inspection speeded.

And See-ability is welcomed by employees, too. For it lessens eye-strain and fatigue, promotes their health and well-being.

When the big job of war production is done, these higher standards of lighting developed by Westinghouse engineers will be available to everyone—to factories and offices, to stores, hotels, theaters and restaurants, and to private homes.

Let your local Westinghouse dealer tell you how Westinghouse Mazda Lamps will give you See-ability, or write Westinghouse Elec. & Mfg. Co., Bloomfield, N. J.
Plants in 25 cities . . . offices everywhere

NO "ABSENTEEISM" HERE!


148T 1¼" P DRIVING SPROCKET (SPLIT)
150 H.P. GENERATOR
H-100 SEXTUPLE CHAIN
CHAIN SPEED 1312 F.P.M.
5" DIA. SHAFT 600 R.P.M.
9" DIA. FLYWHEEL SHAFT 85 R.P.M.
21T 1¼ P DRIVEN SPROCKET
19T TAKE-UP IDLER
OIL TIGHT CASING

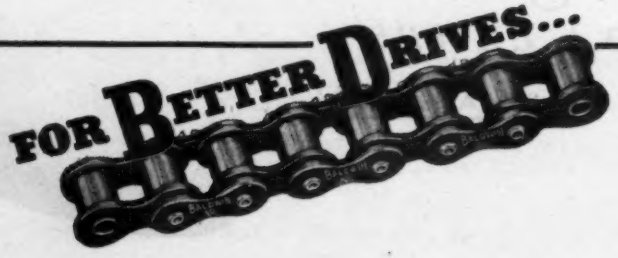
600,000 miles . . . the equivalent of 25 trips around the world . . . that's the distance this chain has traveled with no "time out" for repairs. It's been operating for almost 7 years, yet not one link has been removed . . . "stretching" has been less than nominal.

THE "success" story of this sextuple roller chain Generator drive is typical of Baldwin Roller chain belts. The drive was designed for 150 H.P. but has delivered up to 200 and has been in constant operation since its installation. And outside of periodic lubrication, the drive has required no attention throughout this operating period.

The positive grip of Baldwin Roller chain belts . . . their ability to absorb shock loads . . . the low maintenance and quiet operation that proved so valuable here can help you. For Baldwin Roller chain belts give you these advantages:

1. **Long, trouble-free service**
2. **High shock-absorbing ability**
3. **Easy, simple installation**
4. **No deterioration from oil and grease**
5. **No power loss—with or without adjustment**

For complete information on Baldwin Roller chain belts and how they can help you cut power transmission costs, call your Baldwin Man or write for your copy of Catalog M. Baldwin-Duckworth Division of Chain Belt Company, 327 Plainfield Street, Springfield 2, Mass.



BALDWIN

ROLLER CHAIN BELTS

Speeds Material Handling ...for Victory!

RE-POWER with READY-POWER

Gas-Electric Power Plant for Electric Truck Operation

R-P power for electric truck operation, handles materials at lowest cost per ton.

Baker Fork Truck

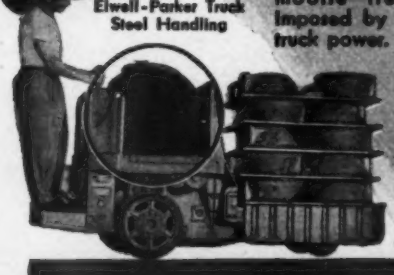
Yale Crane Truck

Hi-Lift Truck

Elwell-Parker Truck Steel Handling

Since 1924, thousands of R-P Units have been adapted by industry to their toughest jobs.

R-P replaces storage batteries and charging equipment—makes the electric truck completely mobile—free from limitations imposed by use of batteries for truck power.



Automatic Platform Truck

R-P power plants are good for the life of the truck—handle the loads quickly.

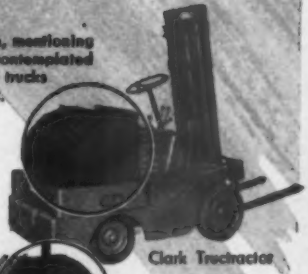
Continuous Power

INDUSTRY TODAY needs Ready-Power more than ever before to handle materials faster, more economically, and to speed up production to the wartime pitch. Ready-Power equipped trucks handle more loads per hour, per day, per year, than the same equipment battery powered. Ready-Power (Gas-Electric) Units convert ordinary trucks into trucks with higher peak performance because of the continuous flow of power.

Peak Performance

The Ready-Power Company *does not make industrial trucks*-but supplies the gas-electric power plants that make electric trucks do more work. Truck manufacturers furnish Ready-Power equipment on new trucks at your request—or you can get Ready-Power units to replace batteries now in operation, direct from The Ready-Power Company.

Write for information, mentioning type of new truck contemplated or make and type of trucks now being operated.



Clark Tractractor

Mercury Tractor

THE READY-POWER CO.

3851 Grand River Avenue • Detroit Michigan, U. S. A.

AMERICAN INSTITUTE OF BOLT, NUT AN
HANNA BUILDI

WE MADE 170 MILLION PIECES...

AND TOMORROW – AND THE NEXT DAY – WE'LL DO IT AGAIN!

In no other field is the manufacturing skill that made American Industries GREAT, better shown than in the FASTENERS INDUSTRY! Ingenuity, craftsmanship, precision, mass-production—all are exemplified in the tremendous output of accurately fitting, uniformly dependable bolts, nuts, rivets and screws that flow in a steady stream to all the factories, mills, railroads, farms that form the backbone of America's War Effort.

From tiny screws in electrical appliances to huge bolts in heavy machines, *precision* and *large production* combine here to give American manufacturers—in war or peace—a complete assortment of dependable fasteners that fit right—hold tight!

TWO PUBLICATIONS YOU NEED

"FASTENERS" brings you new, useful and authoritative data at regular intervals. Free.

The "HANDBOOK" contains 175 pages of engineering reference data on Fasteners. Price $1.00 per copy.

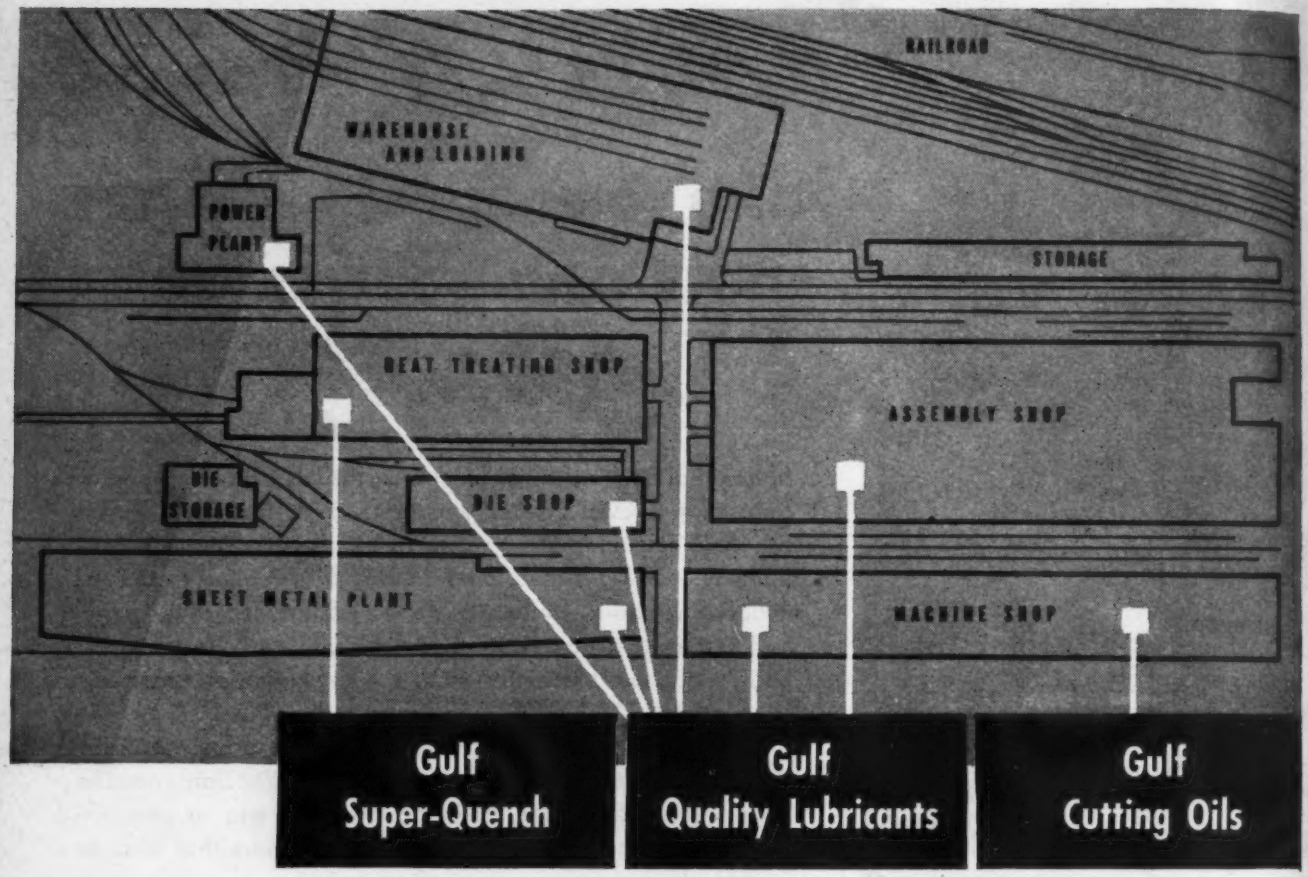
USE HEADED AND THREADED FASTENERS FOR ECONOMY-RELIABILITY

RIVET MANUFACTURERS

CLEVELAND, OHIO

Gulf Quality Petroleum Products

help increase output in every plant department—



For every department in your plant, there's one or more Gulf quality petroleum products that can help you increase output and secure dollar savings.

Here are a few of the many Gulf products that are doing an outstanding job in metal-working plants—helping to produce more and better war equipment:

Gulf Super-Quench—A revolutionary new quenching oil that assures maximum oil-quenched physical properties in steel, with minimum distortion and cracking—makes many steel parts harder and stronger than has ever before been possible with oil quenching.

Gulf Cutting Oils—In plant after plant, Gulf Cutting Oils have set new standards for production, tool life, and work finish—up to 400% increase in output per machine, up to 2,000% longer tool life, and outstanding improvement in finishes.

Gulf Quality Lubricants provide an extra margin of protection against excessive wear and resulting mechanical troubles — help keep machines producing at top wartime speed and efficiency — are good production insurance.

Let a Gulf Service Engineer assist your operating and production personnel in the selection and application of petroleum products best suited to your particular requirements. Write, wire, or phone your nearest Gulf office today.

Behind Gulf products and Gulf Service Engineers is a large corps of research technologists who constantly study lubrication and related problems in Gulf's well-equipped laboratories.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH, PA.

DON'T HANG YOUR PRODUCTION ON A *Shoestring* PLANT POWER SYSTEM

● **POWER DISTRIBUTION SYSTEMS, like shoestrings, are generally kept in service till something *snaps*. Minor troubles are laid to other causes, and major breakdowns come too late for preventive remedy.**

Today, many otherwise well-equipped plants are "just getting by on a shoestring" when it comes to electric power supply, with make-shift circuits, hand-me-down equipment, and long, overloaded feeders.

If your power system was adapted and extended under pressure to carry loads it was never designed to meet, the chances are that it's partly or wholly inadequate—it's the overlooked cause of outages, poor lighting, sluggish drives, high power losses, extra maintenance expense, and danger to personnel. Nurse it through for the time being if you must, but plan your next move to get away from these risks and losses.

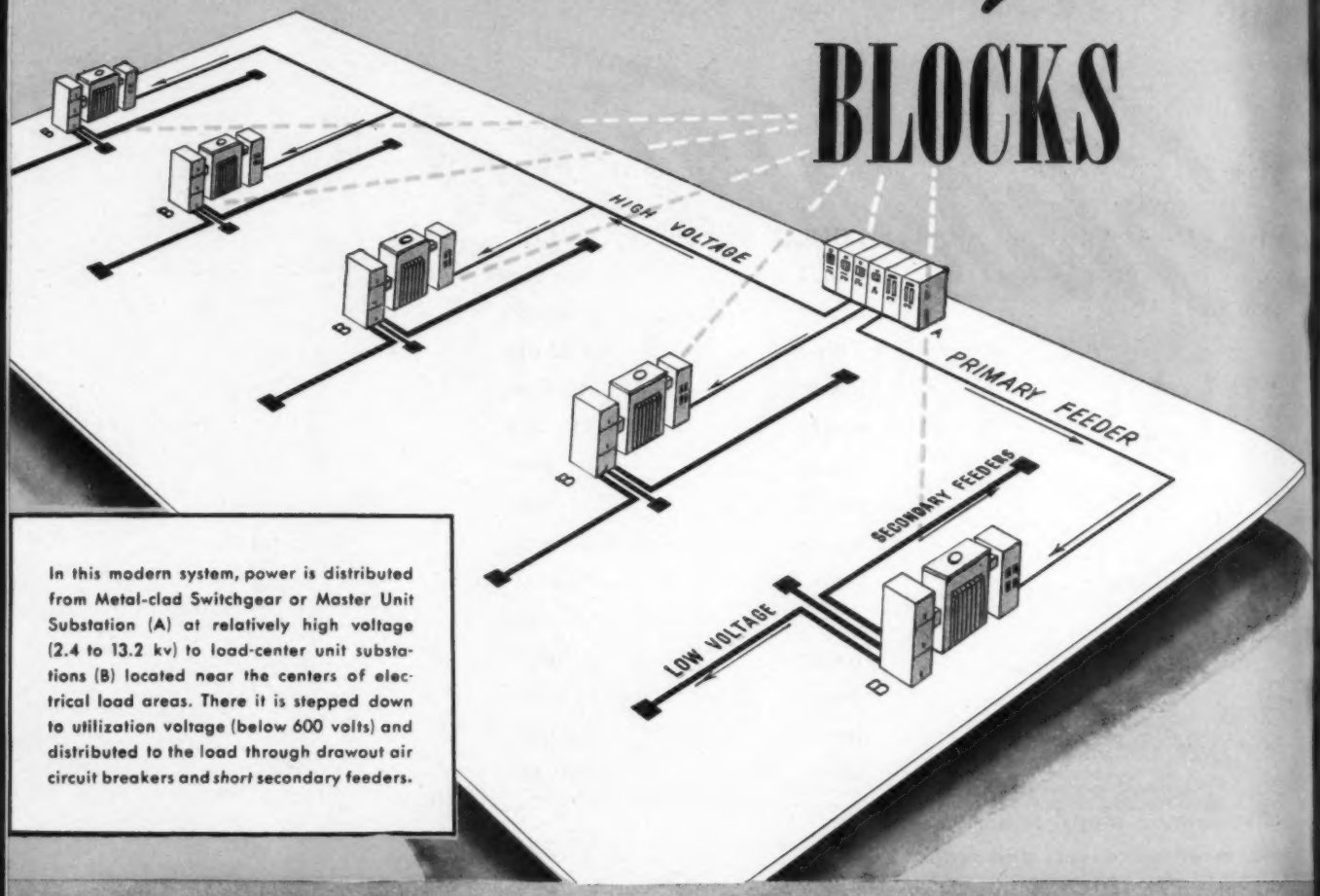
HERE'S *News* . . .

of modern power distribution. G.E.'s load-center system, which you can install as a complete system, or block by block until the complete system is assured.

GENERAL ELECTRIC

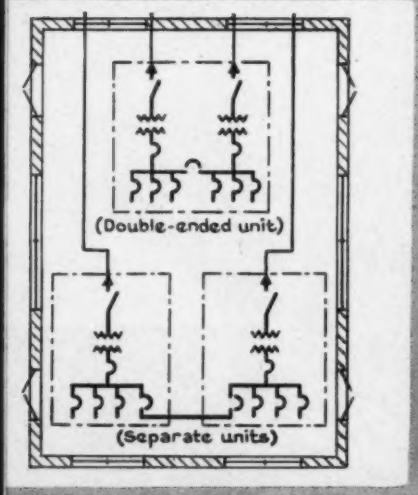
302-27-5900

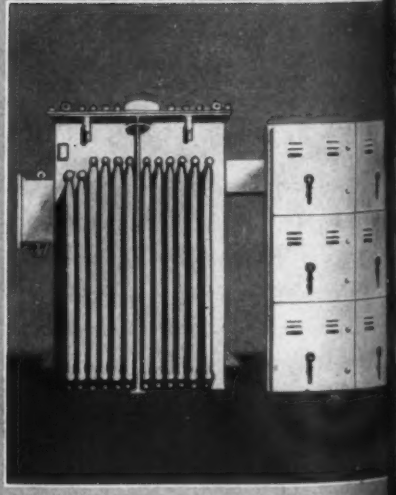
Electric POWER-SUPPLY SYSTEM *based on ready-built* BLOCKS



In this modern system, power is distributed from Metal-clad Switchgear or Master Unit Substation (A) at relatively high voltage (2.4 to 13.2 kv) to load-center unit substations (B) located near the centers of electrical load areas. There it is stepped down to utilization voltage (below 600 volts) and distributed to the load through drawout air circuit breakers and *short* secondary feeders.

IE CIRCUIT ARRANGEMENT YOU NEED — BUILT UP FROM CO-ORDINATED UNITS — OF STANDARD DESIGNS





To system is more *flexible* than load-enter distribution. Units can be combined any one of a number of basic circuit rrangements. (Diagram shows secondary-elective hook-up.)

Like a set of blocks, the elements that go to make up a complete electric power system can be combined in many ways, without engineering or construction delays. All parts are designed to work together.

The components of a G-E unit substati are of standard design. Installation a maintenance are simplified; no worr about oddities or misfits. You get exact the right assembly for the load condition

SAFEGUARDS

Your Plant from Crippling Outages

THIS MODERN SYSTEM FOR DISTRIBUTING ELECTRIC POWER protects your plant from power shutdowns in two ways: Low-voltage power is distributed from unit substations within definite load areas. Circuit protection here ISOLATES trouble, leaving all other areas unaffected.

In addition, each individual substation is unusually strong in SELF-PROTECTION features. By co-ordinated "system" arrangements, two or more sources of supply to any local circuit can easily be provided.

DELIVERS

Full Voltage to Every Lamp and Machine

LONG, CIRCUITOUS LOW-VOLTAGE FEEDERS are eliminated by the load-center system. This ends the basic cause of most low-voltage troubles, and limits costly IR-drop losses. Dim lighting and sluggish power are avoided. Each substation is matched to local load conditions within your plant, and delivers full-voltage power over short, direct feeders to motor controls, lighting panels, and the like. Wiring problems are simplified. Naturally, this method also means great savings in cable copper.

Ask for Bulletin GEA-3758A

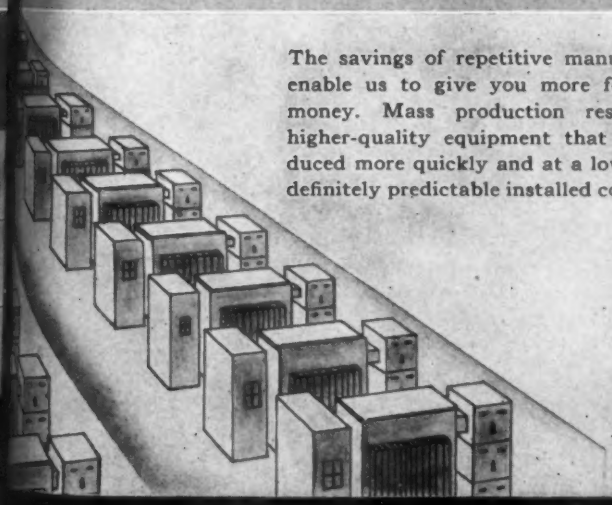
SAVES TIME

In Plant Planning and Conversion

LOAD-CENTER POWER DISTRIBUTION SYSTEMS enable your engineers to make maximum use of available standard apparatus such as unit substations and metal-clad switchgear. They can be laid out by means of a simple "one-line" diagram, fitting ready-built equipment combinations to your specific needs. This method permits placing orders months earlier, and thereby gets plants into production sooner.

If plant conversion alters power loads, substations can be quickly relocated.

REPETITIVELY MANUFACTURED



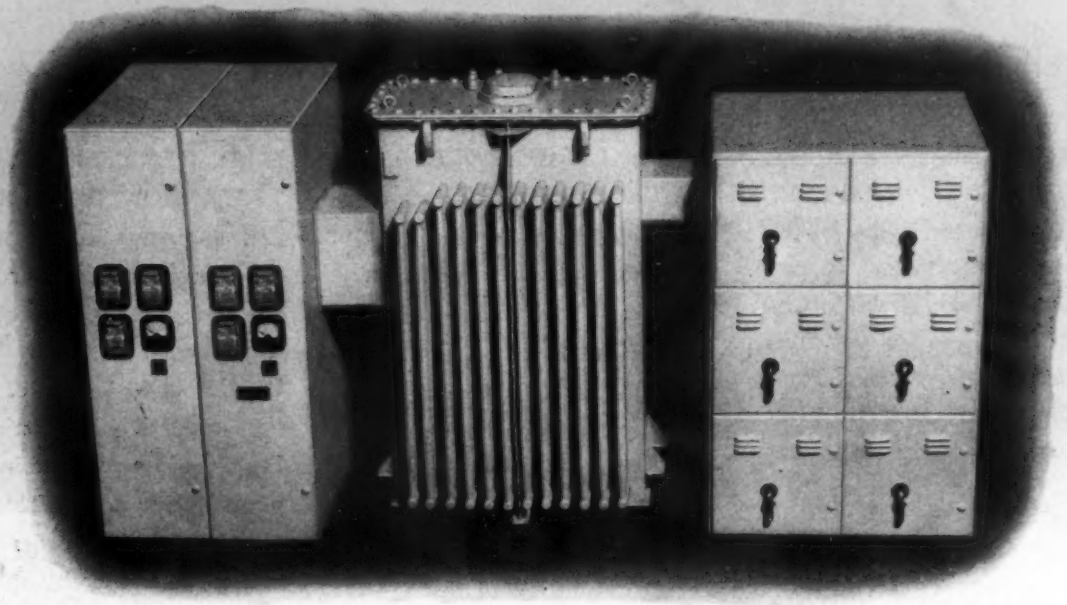
The savings of repetitive manufacture enable us to give you more for your money. Mass production results in higher-quality equipment that is produced more quickly and at a lower and definitely predictable installed cost.

LOAD-CENTER POWER DISTRIBUTION SYSTEMS

GENERAL ELECTRIC

THE G-E UNIT SUBSTATION

Is the Basic Building Block of Load-center Systems



★ **Each block is a completely co-ordinated unit, as easy to specify as a standard machine tool.**

★ **Safely "at home" anywhere in the plant because of the Pyranol transformer and metal-enclosed switchgear.**

★ **Offered in flexible combinations of incoming-line and secondary-circuit arrangements, from 200 to 2000 kva.**

Metal-clad primary protection. Each high-voltage circuit is isolated in its separate, grounded, steel compartment.

Vertical-lift breakers are easily removable for inspection. For safety's sake, you can't elevate or lower breakers unless they are open.

Drawout air circuit breakers for secondary circuits are individually metal-enclosed. Breakers are interchangeable, avoiding delays during routine maintenance. Interrupting capacities are correct for the transformer ratings.

The PYRANOL* transformer section makes vaults unnecessary for indoor installation. No Pyranol transformer has ever burned or contributed to a fire.

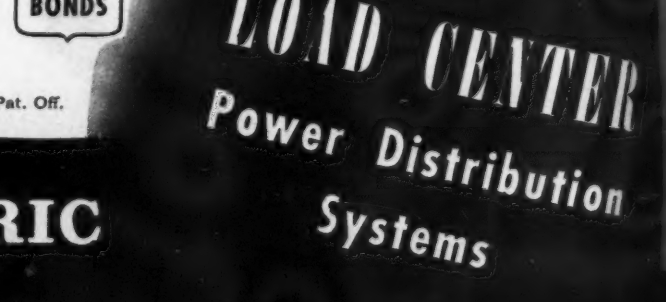
Pressure-tight tanks protect vital parts from dust, dirt, dampness. Little or no maintenance is required.

The heat-storage capacity of the core-and-coils and of the cooling liquid makes the Pyranol transformer ideal for emergency overloads.

As an integral part of a G-E unit substation, each transformer is electrically matched with its accompanying primary and secondary switchgear.

More information in Bulletin GEA-3592. *General Electric Company, Schenectady, N. Y.*

Ask your local G-E representative about—



BUY WAR BONDS

*Reg. U.S. Pat. Off.

GENERAL ELECTRIC

Omaha Public Lib
Reference Dept.

When a tiny spring speaks for all America...

IF, when one of our bombs hits the roof of a German factory it explodes instantly it will break windows and rip off some of the roof, but it won't do a great deal of interior damage. On the other hand, if it penetrates four or five floors and *then* explodes . . . the factory simply won't be there any more. Worcester Wire Works' contribution to this desired result is the wire in the tiny steel spring, activating the delayed-action fuse in the bomb's nose. If it fails, the bomb is a dud and the lives of our fliers have been risked needlessly . . .

A background of many years' experience in producing fine wire at Worcester Wire Works is assurance that the important little fuse spring will not fail.

In peacetime, Worcester makes wire for such divergent uses as wire for rope, piano strings, staples for paper milk bottle tops, wire for springs, indicators for instruments, brushes, and many others. The experience of our research and engineering staff is available to help you solve wire problems or to work out with you new uses for wire in *your* business.

★ ★ WORCESTER WIRE WORKS ★ ★

Divisions of National-Standard Company

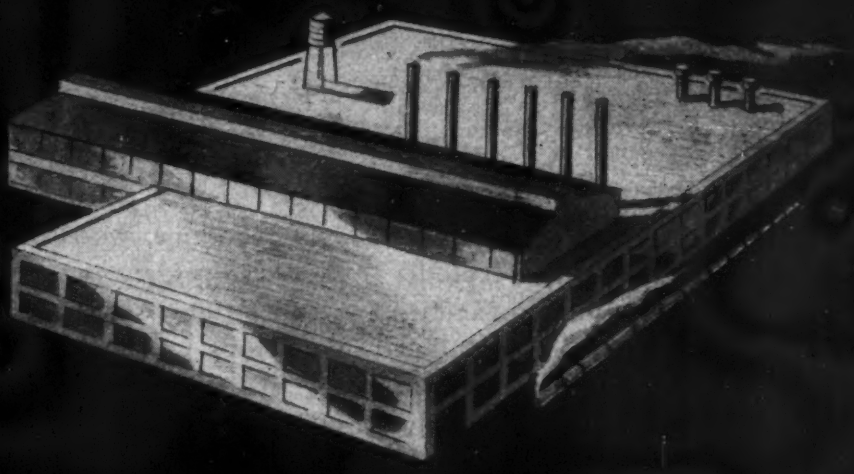
WORCESTER WIRE WORKS
Worcester, Mass.
•
ROUND STEEL WIRE, SMALL SIZES

NATIONAL-STANDARD
Niles, Mich.
TIRE WIRE, FABRICATED BRAIDS AND TAPE

WAGNER LITHO MACHINERY
Hoboken, N. J.
LITHOGRAPHING AND SPECIAL MACHINERY

ATHENIA STEEL
Clifton, N. J.
•
FLAT, HIGH-CARBON STEEL

out of obscurity



into the sun

There is a brighter side. From $319 in 1914, net income per capita in these United States climbed to $875 (est) in 1943. Increase in cost of living jumped 76% in the 1913-1918 period of War I. The first five years (1938-1943) of World War II show a climb of 24%. Close of 1944 may well see an accumulated "buying reservoir" of $100,000,000 in American socks. Your plant expanded for war. How about your vision? Has it expanded to include the "peace-work" future? To turn a profit, then, calls for turning, now, from production at any cost to production at lowest cost. Look at your lathes, for instance. Then look to LeBlond.

THE R.K. **LeBLOND** MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

CHICAGO 6, 20 N. Wacker Dr. STA 5561

time to retool

Turn to Le Blond for Turning Equipment

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY E NAVY

LE BLOND

HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24" Best for training.

Automatic Crankshaft Lathes—For all facing, turning, finishing, pins.

Tool Room Lathes—12", 14", 16" and 18" swings. Versatile.

HD Gap Lathes—Ten sizes in Regular and Sliding Gap models.

Rapid Production Lathes—13", 17", 20" swings. Six speeds. Faster output. Lower cost.

No. 2 Cutter Grinder—Internal, cylindrical, face and angular work.

Check-Clip-Mail

FOR ILLUSTRATED SPECIFICATIONS:

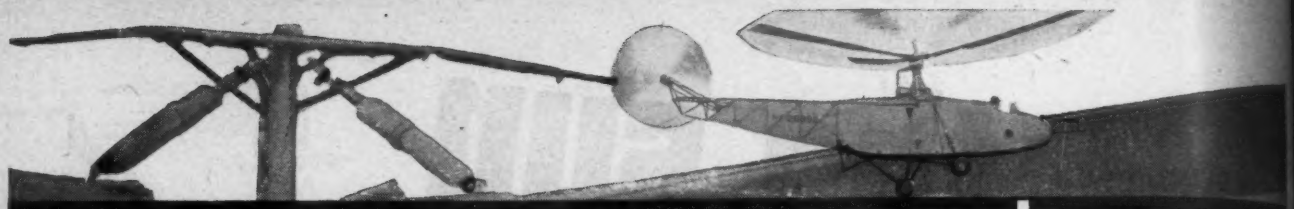
- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____

YOUR FIRM _____ ADDRESS _____

★ YOUR BONDS BUY BOMBS ★

BUY A "BLOCK-BUSTER" TODAY!



SAFEGUARDING THE HELICOPTER'S HEART

One feature that has played an important part in the success of the Sikorsky helicopter is the development of "cyclic pitch control."

The mechanism that operates this control passes through the main rotor hub.

It is the heart of the helicopter.

And you will find this heart fastened safely and securely with Elastic Stop Nuts.

These are the nuts with the red elastic collar—the nuts which have revolutionized aircraft construction.

That red collar hugs the bolt and grips tight. It does not loosen under vibration or shock. It locks fast—anywhere on the bolt.

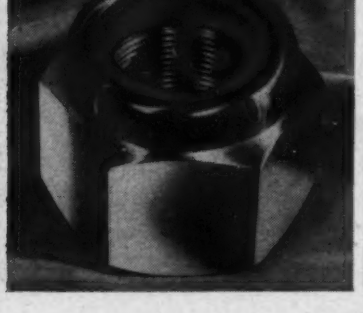
Nevertheless, you can take Elastic Stop Nuts off, and put them back on, time and time again, and they still retain their locking effectiveness.

Elastic Stop Nuts are going to prove godsends in countless postwar fastening problems. They will make products safer, better and longer lasting.

Any time you wish, our engineers will be glad to help with whatever fastening job you might have. They will recommend the correct Elastic Stop Nut to meet the situation.

Elastic Stop Nuts are an old story on Sikorsky aircraft. They have been used on the Sikorsky clipper ships for years. They are found throughout the helicopter holding important structural fastenings.

LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING RED COLLAR.
THE COLLAR IS ELASTIC, THE NUT CAN BE USED TIME AND TIME AGAIN.
MADE IN ALL SIZES AND TYPES—WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS.



ESNA

TRADE MARK OF

ELASTIC STOP NUT CORPORATION OF AMERICA
UNION, NEW JERSEY AND LINCOLN, NEBRASKA

ELASTIC STOP NUTS

Lock fast to make things last

Sure, we're right behind them . . . but how far?

What is there that's so dramatic about this picture of American fighting men wading in to mop up the Japs on Makin?

We believe it's the sheer suspense of the situation; the feeling that "all hell is going to bust loose" any moment . . . and that some fine American kids are going to get hurt – or maybe killed.

We don't like that feeling, either. Somehow it just doesn't seem right that those boys should be out there laying their lives on the line, while we're back home all safe and sheltered.

But what more can we do about it than we're already doing? Isn't America producing more fighting tools than all the Axis nations?

Yes . . . but that's not enough. In spite of our tremendous war output we are squandering millions of precious man-hours through industrial slow downs. When you think what those lost hours mean in terms of supplies that would save lives by shortening the war, you take less pride in our "record" production figures.

While it's true that some time is lost through industrial slow downs that are unavoidable, there are certain slow downs which can and should be prevented. One of these is the slow down caused by *valve failure.*

The one way to forestall such slow downs is to *prevent valve trouble before it starts* . . . by frequent, systematic inspection of valves . . . by repairing or replacing worn parts before valves destroy themselves . . . by training new workers to operate and maintain valves properly . . . by selecting new valves carefully and installing them correctly!

Jenkins engineers are ready to assist any management in developing a program of valve conservation.

Jenkins Bros., 80 White Street, New York, 13, N. Y.; Bridgeport, Atlanta, Boston, Philadelphia, Chicago, Jenkins Bros., Ltd., Montreal; London, England.

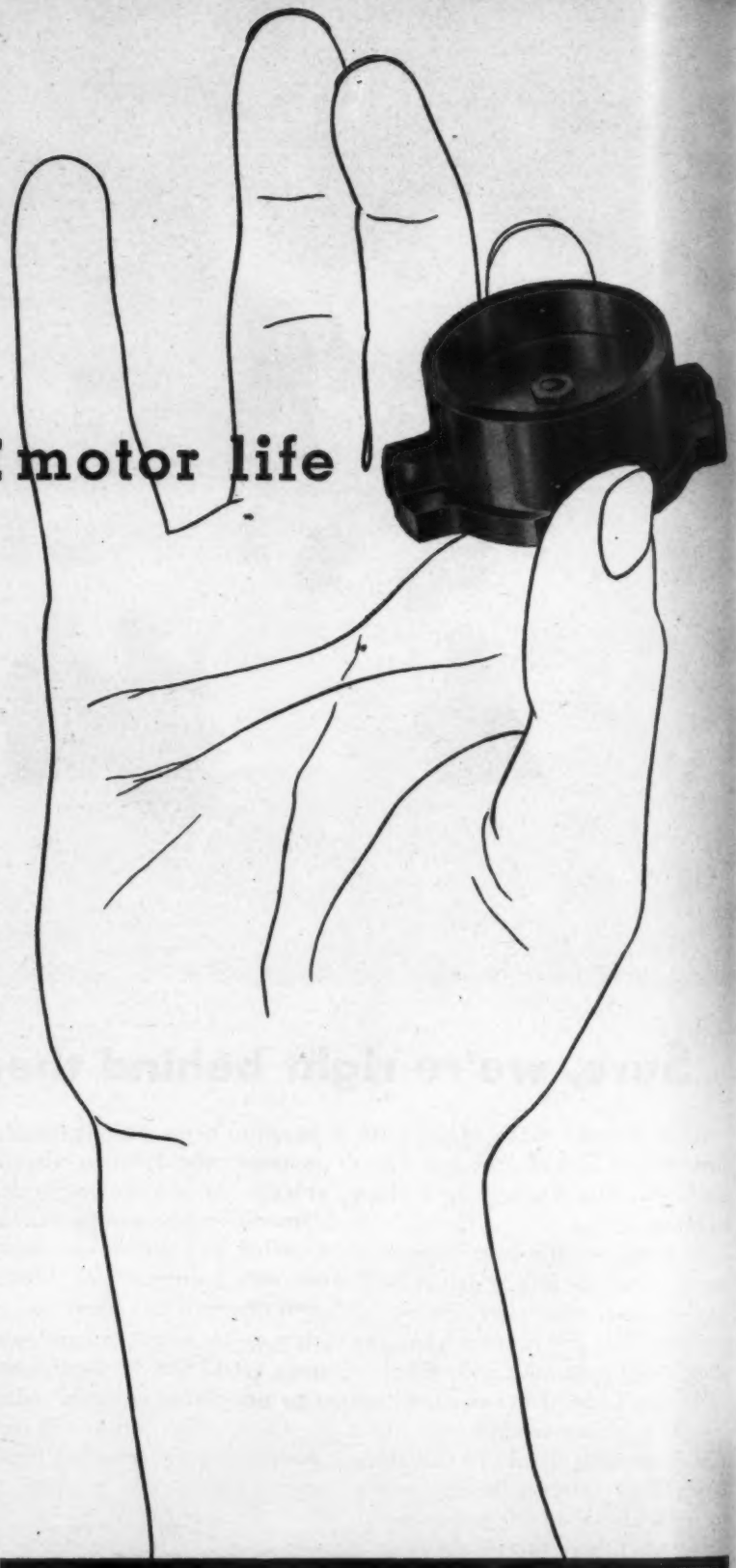
Reprints of this advertisement are available for display in your plant.

JENKINS VALVES

SINCE 1864

For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

They **STRETCH** motor life



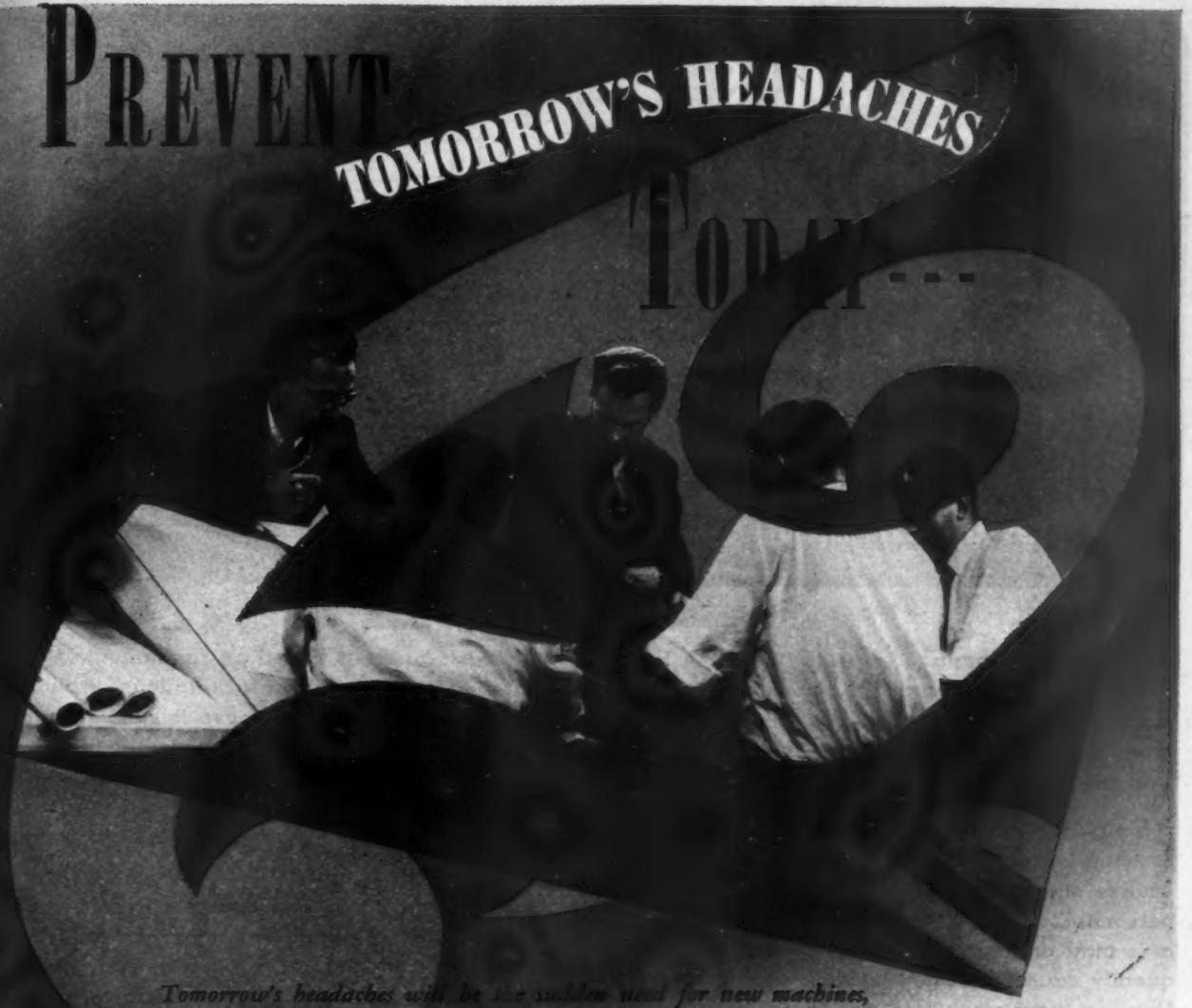
Small, simple and inexpensive, a Klixon Protector, built right into a motor, protects the motor from overheating and burning out. You can operate the motor at peak capacity always . . . but as soon as you overload the motor to the point where it gets dangerously hot, the Klixon Protector automatically cuts the motor off the line and prevents it from burning out. When the motor cools sufficiently, it starts up again automatically or by manual reset. Yes, Klixon Motor Protectors really *stretch* motor life by eliminating burnouts and costly repairs.

Get the most out of your motors. Specify Klixon Protectors on all the motors you buy. They can be had on AC motors, all sizes; DC motors up to 30 volts.

KLIXON CIRCUIT BREAKERS

SPENCER THERMOSTAT CO., ATTLEBORO, MASSACHUSETTS

PREVENT TOMORROW'S HEADACHES Today...



Tomorrow's headaches will be the sudden need for new machines, new tools, and new products that are not even designed.

Today's headache is trying to plan for the post-war rush tomorrow with an already over-taxed, war burdened engineering staff.

Let's have no headaches, unnecessarily! *Today's remedy for both situations* is to call upon the 220 engineers, designers, tool makers, draftsmen and technical experts who comprise Siewek Engineering Division. At any point from bare idea to manufacturing set-up, this nationally known organization is prepared to bring brains, skill and broad experience to your service. Whatever your problem involves, Siewek stands qualified *and prepared* to solve it.

A letter, *today,* will bring you details of Siewek Engineering and some of its accomplishments, past and present. A request now, will bring a Siewek representative to discuss solutions of tomorrow's problems.

SIEWEK

Designers and Builders of Tools, Dies, Jigs, Fixtures and Special Machines

ENGINEERING DIVISION

OF DOMESTIC INDUSTRIES, INC.

Chicago 10: 506 N. Dearborn St.

Detroit 26: 2011 Park Ave.

Hartford 3: 209 Pearl St.

OVERDUE ORDERS REDUCED 78% with McCASKEY PRODUCTION CONTROL in the first few weeks of operation

● "Manpower shortage" is in the headlines almost every day. We are warned that it soon will be much more serious. At the same time, the need for good production control now and for the transition from war production to peace production increases.

Simplicity of control becomes more and more essential. Complicated systems calling for close executive supervision, the services of highly trained personnel, or the interpretation of voluminous records may appear attractive in theory, but they frequently cause confusion because of the difficulty of keeping them up-to-date and accurate.

McCaskey Control of scheduling, machine load, job assignment, order progress, and other production essentials is based on fundamentals tried and proved in thousands of installations. An extra copy or two of time tickets, move tickets, shop orders—forms you are using today—visibly filed for quick reference on McCaskey Planning Boards—provide all the data you need when you need it. Clerical work is simple and very much less than with other systems.

Let us give you one example from a well-known New England plant. Adoption of McCaskey, they told us, provided all the information desired and brought to light glaringly unsatisfactory conditions. In the first few weeks of operation overdue orders were reduced from 192 to 42. Shortly afterward they were entirely under control.

TYPICAL NEEDS SATISFIED BY McCASKEY PRODUCTION CONTROL

. . . Flow of finished parts coordinated to avoid either excessive or unbalanced inventories or assembly delays resulting from missing units.

. . . Progress record showing immediate status of any or all orders *at a glance* is complete inventory of work-in-process.

. . . Forecast of production delivery.

. . . Machine scheduling, departmental machine loads and job assignment to keep all machines busy all the time and run jobs in proper sequence.

. . . Check of machine production to assure realization of production standards.

. . . Based on primary records — always up-to-date.

. . . Production follow-up without dependence on stock chasers.

. . . Day to day cost and payroll data for immediate control of unexpected increases.

. . . Unified control of inventories of material, purchased parts, parts produced, sub-assemblies, tools, supplies, etc.

. . . Tool crib control providing more production with less tools.

. . . Although the specific needs of plants and departments differ, the flexibility of McCaskey Production Control makes it adaptable to practically any of the severe production conditions existing today. You name your requirements and McCaskey will satisfy them.

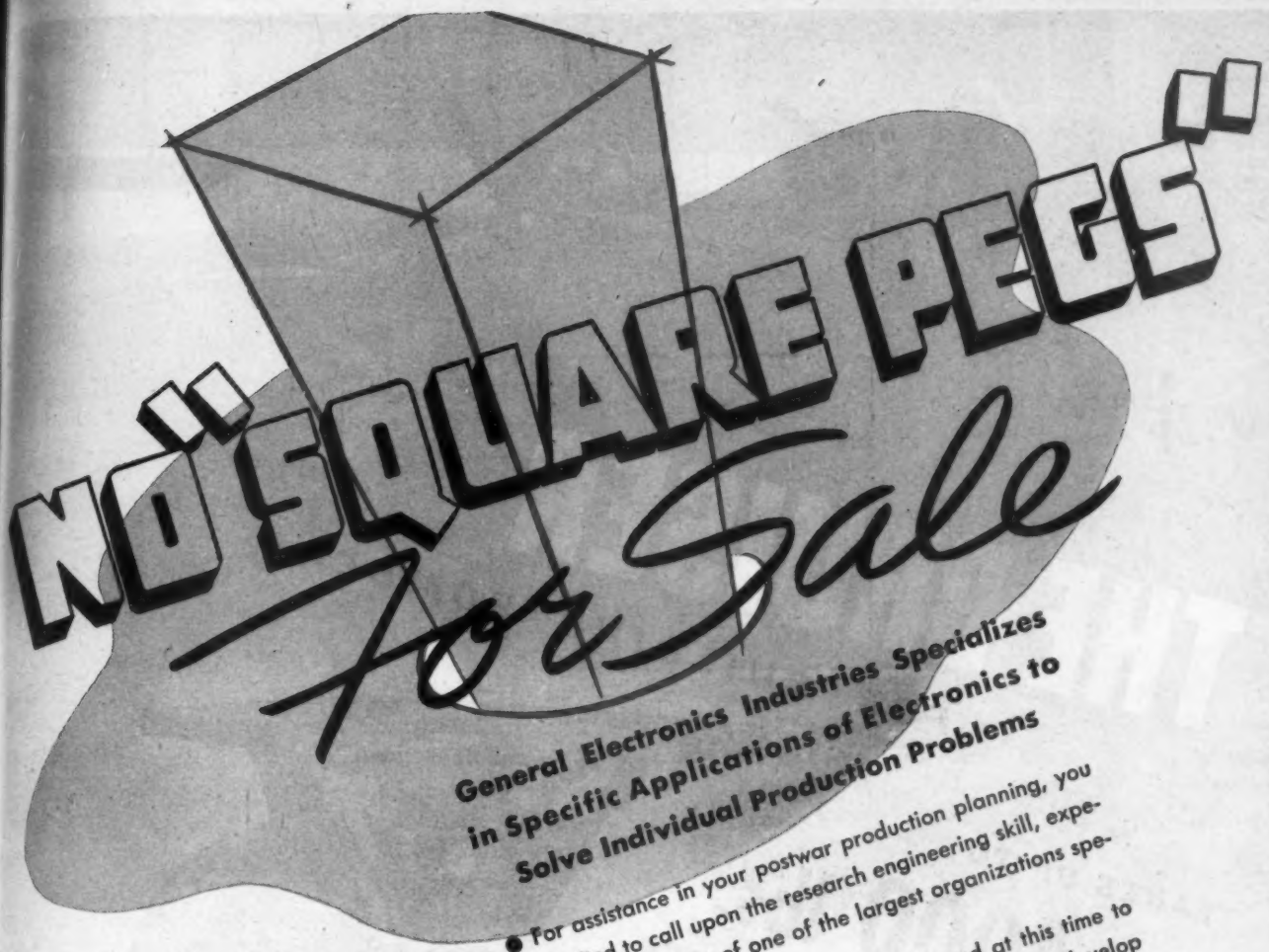
A McCaskey representative, qualified by training and experience, is available to help you work out your production control requirements. Call him in or write for more specific data. No obligation, of course.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL



NO "SQUARE PEGS" For Sale

General Electronics Industries Specializes in Specific Applications of Electronics to Solve Individual Production Problems

● For assistance in your postwar production planning, you are invited to call upon the research engineering skill, experience and facilities of one of the largest organizations specializing in electronics.

General Electronics Industries is prepared at this time to study your electronics requirements and to design or develop the application that will fit your individual purpose. Thus, you will gain a head start in your future postwar production, with the perfect electronic devices General Electronics Industries will be ready to supply as soon as its manufacturing facilities are no longer engaged in all-out war effort.

Write to Engineering Department, General Electronics Industries, 342 West Putnam Avenue, Greenwich, Connecticut.

ARMY-NAVY "E" WITH STAR awarded to Auto-Ordnance Corporation for continued excellence in production of "Tommy" Guns.

GENERAL Electronics INDUSTRIES

TRADE-MARK REG. U.S. PAT. OFF.

Division of Auto-Ordnance Corporation

GREENWICH • STAMFORD • BRIDGEPORT • NEW MILFORD • NEW YORK

THE BRUISER

4000 lbs. PER CASTER

Here is a little giant with the strength to take the heavy parts used in the assembly of large bombers. Free-swiveling, light rolling —four of these Bruisers will handle up to 16000 lbs. with ease.

Check this New FORGEWELD

Against Your Requirements

- ☐ UNBREAKABLE—Top plate forged of SAE-1045 carbon steel with integral king bolt. Yoke base forged of SAE-1045 steel with structural steel legs.
- ☐ Swivel—double ball race in machined raceways with Brinell hardness of 230.
- ☐ Axle and King Bolt 1¼" diameter.
- ☐ Wheels—cast steel, certified malleable iron or moulded plastic type.
- ☐ Size of wheels—Standard, 8" to 12" diameter.
- ☐ Hyatt or Timken roller bearings.

SERVICE CASTER & TRUCK DIVISION
OF DOMESTIC INDUSTRIES, INC.
505 N. Brownswood Avenue, Albion, Michigan

434 Somerville Ave., Somerville (Boston) Mass. — Toronto, Canada: United Steel Corporation, Ltd., SC&T Co. Division

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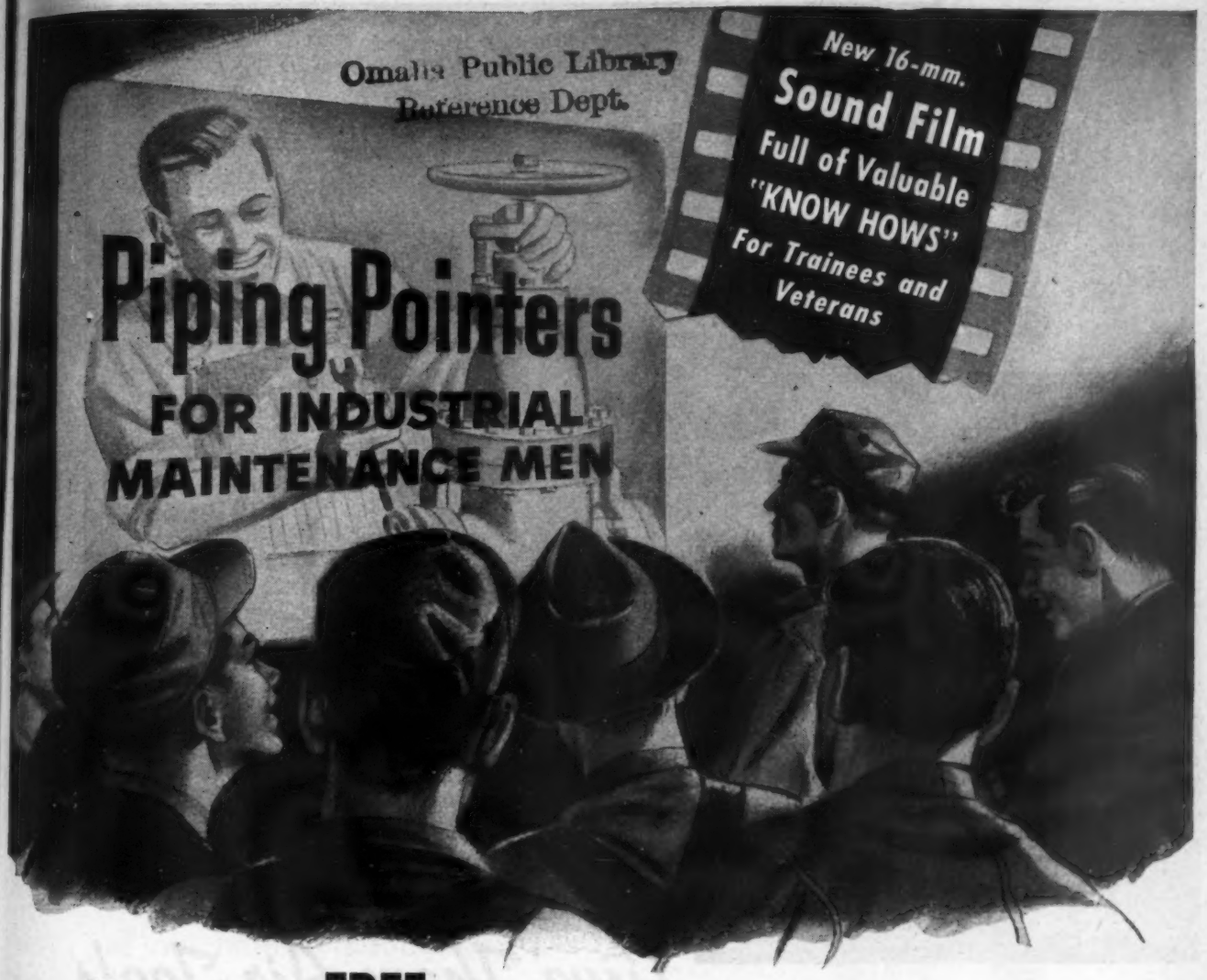
ARMY E NAVY

Omaha Public Library
Reference Dept.



Now being shown FREE in any plant

SEEING this film gives maintenance trainees a quicker grasp of their jobs—a better understanding of various types of valves and fittings—how they are used and installed to insure long life and good performance. In addition, *"Piping Pointers"* explains correct maintenance procedures—shows how to conserve time and materials on the job.

Because *"Piping Pointers"* is packed full of authentic and practical information—because its ultimate benefit is better service from piping equipment—numerous plants are showing it to both trainees and veteran workers.

New Training Manual Included

Making *"Piping Pointers"* even more effective, is a new comprehensive training manual which covers in greater detail each subject treated in the film. It can be used with the film or separately.

Both the film and manual are the first of their kind ever compiled. But more important is that each lesson they give can be fully depended on as the best information available. For their content is based entirely on Crane Co.'s 88-year experience as the leading maker of valves and fittings.

Act Now to Show This Film to Your Men—More and more requests for *"Piping Pointers"* are coming in daily. Assure a convenient early showing in your plant by getting in touch with your local Crane Branch promptly. Use of the film will be arranged and manuals provided for every viewer. Just call your Crane Branch, or, if you prefer, fill in and mail the coupon below.

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Illinois.

FILL IN AND MAIL TODAY

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Attention: Advertising Dept.

Put us down for the earliest possible showing of *"Piping Pointers."* Have the local Crane Branch get in touch with me.

Name.....

Title.....

Company.....

Address.....

City.....*State*.....

CRANE VALVES

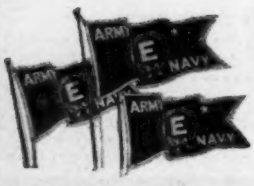
GIVE THEM THE BEST

Give Them Air Tools

The cost of power for any portable tool is small when compared with the operator's wages. Therefore, consider aiding your operators by giving them smaller, lighter and more powerful AIR tools which will enable them to do an easier, quicker and better job.

Flexibility of *AIR* Power . . . More types of work can be done with AIR tools than with any other type of portable tools. Their wide range includes not only rotary applications (such as drilling, reaming, grinding, nut running, etc.), but also such percussive applications as riveting, chipping, ramming, tamping, etc.

Flexibility of Control . . . AIR-powered tools can be started and stopped instantly—this speeds up repetitive operations. Torque and speed can be varied throughout the capacity range—full power can be obtained immediately. This control permits the operator to fit the tool exactly to his work from moment to moment.



Flexibility of Application . . . Flexible control automatically gives the AIR tool wide application. It can be used on a great variety of materials—it will handle numerous types of jobs in any shop.

Choose from the complete line of I-R AIR tools . . . and increase your production.

Ingersoll-Rand

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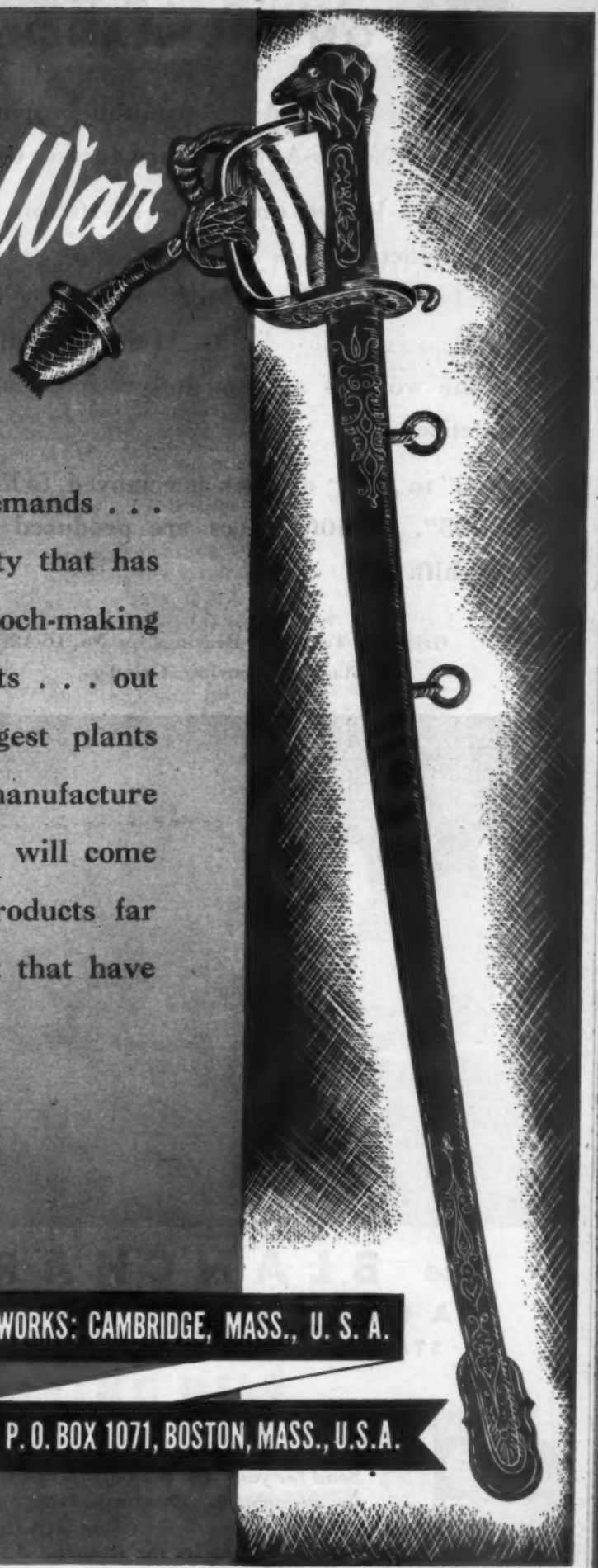
COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • OIL AND GAS ENGINES

WHEN THE *Sword of War* IS SHEATHED



Out of war's insatiable demands . . . out of experience and ability that has made rubber history in epoch-making inventions and improvements . . . out of one of the world's largest plants devoted exclusively to the manufacture of mechanical rubber goods, will come belting, hose and similar products far surpassing the world's finest that have come so far.

BOSTON WOVEN HOSE AND RUBBER COMPANY

BWH

WORKS: CAMBRIDGE, MASS., U. S. A.

P. O. BOX 1071, BOSTON, MASS., U.S.A.

"PUT IT ON THE BLANCHARD"

These heat treated steel trunnion bearings are ground on a No. 16-A2 Blanchard Surface Grinder.

They are loaded on special 80-station fixture with magnetic studs locating from previously ground surface. The end of the bearing is then ground to very close limits. At the unloading station the work is automatically ejected and demagnetized.

.005" to .015" of stock is removed, to limits of ± .0005". 18,500 pieces are produced per 8 hour shift.

Grinding Trunnion Bearings on No. 16-A2 Blanchard Surface Grinder.

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ Production
- Adaptability
- Fixture Saving
- Operation Saving
- Material Saving
- ★ Fine Finish
- ★ Flatness
- ★ Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

"In Precision Grinding make certain the wheel fits the operation"

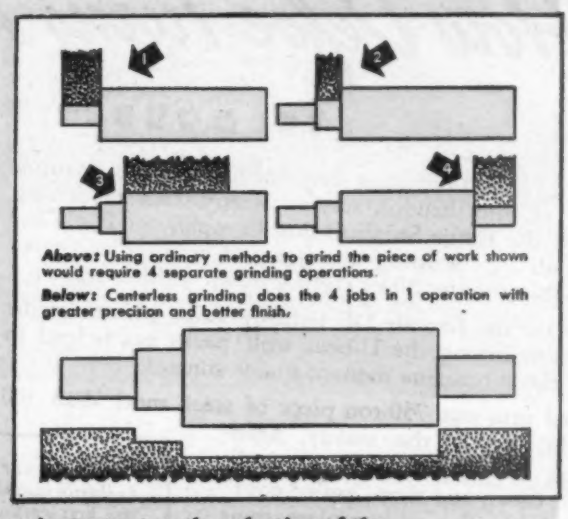
says C. E. QUAY, General Mgr.
OHIO TOOL COMPANY
Cleveland, Ohio

Ohio Tool Company, engaged 100% in war work, is today one of the largest manufacturers of small arms ammunition tools. This accomplishment has been made possible by the development of new methods and equipment, which, in turn, have resulted in a higher rate of production at lower cost.

"TO use a different wheel for every grinding operation in the plant would be a highly impractical and costly proposition. On the other hand, using too few wheels to do a multiple number of jobs sacrifices accuracy and speed of production; requires more manual handling.

"The answer to this problem is profile or centerless grinding . . . a development that grew from the unprecedented production demands of World War II. Precision profile grinding, for example, has made it possible to finish small arms ammunition tools, principally punches, on a production basis. Previously they had been ground singly or a few at a time on conventional tool-room grinding equipment. Internal grinding to finishes of 2 to 4 micro inches is not uncommon on small arms ammunition tools.

"As the sketches below indicate, the ability to centerless-grind several diameters, including tapers, radii, profiles, etc., simultaneously, has reduced what formerly required several operations, to one. In this way, less equipment is needed to produce larger quantities of more uniform tools, releasing additional equipment for other war necessities."



Above: Using ordinary methods to grind the piece of work shown would require 4 separate grinding operations.

Below: Centerless grinding does the 4 jobs in 1 operation with greater precision and better finish.

The proper selection of grinding oils is as important as the selection of the correct grinding wheel. That's why Shell Lubrication Engineers have developed a control technique that "tailor-makes" the oil to fit the machine, the application, and the tool. Ask the Shell man for the details.

SHELL CUTTING OILS

FOR METAL CUTTING AND GRINDING

SHELL

How Defoe Turns Things Upside Down

TO DOUBLE PRODUCTION OF WARSHIPS!

WITH record-breaking frequency, these days, flashing axes bite through stay-hawsers on the launching ways of the Defoe Shipbuilding Company at Bay City, Michigan . . . sending another and another destroyer escort ship for the Navy sliding down to blue water.

These are the famous DE fighting ships whose terrific execution among the U-boat wolf packs has helped to bring the submarine menace under control.

Welded into one 750-ton piece of steel, more than 300 feet in length, the sturdy, hard-hitting DE type ships are built upside down and then "rolled over" in their cradles to complete their equipment. This unique Defoe method of building ocean-going ships, eliminates the need of conventional ship scaffolding and by enabling workers to stand *over* the job from beginning to end gives remarkable advantages in saving time and labor costs. Among results obtained by Defoe engineering methods is the *doubling of production per man hour—with twice as many ships being built at half the labor cost per vessel!*

Until the Axis is defeated, the full facilities of the Defoe organization will be concentrated exclusively on all-out production for Victory.

But tomorrow, when Peace is restored, the experience and improved techniques learned in war work will be used to create new high standards of quality, value and economy in finer products for the consumers of America.

"Next to our immediate task of building warships faster and faster, the first responsibility of Defoe is to plan for post-war operation that will provide the maximum of gainful employment."

HARRY J. DEFOE
Founder Defoe Shipbuilding Co.

★ ★ ★

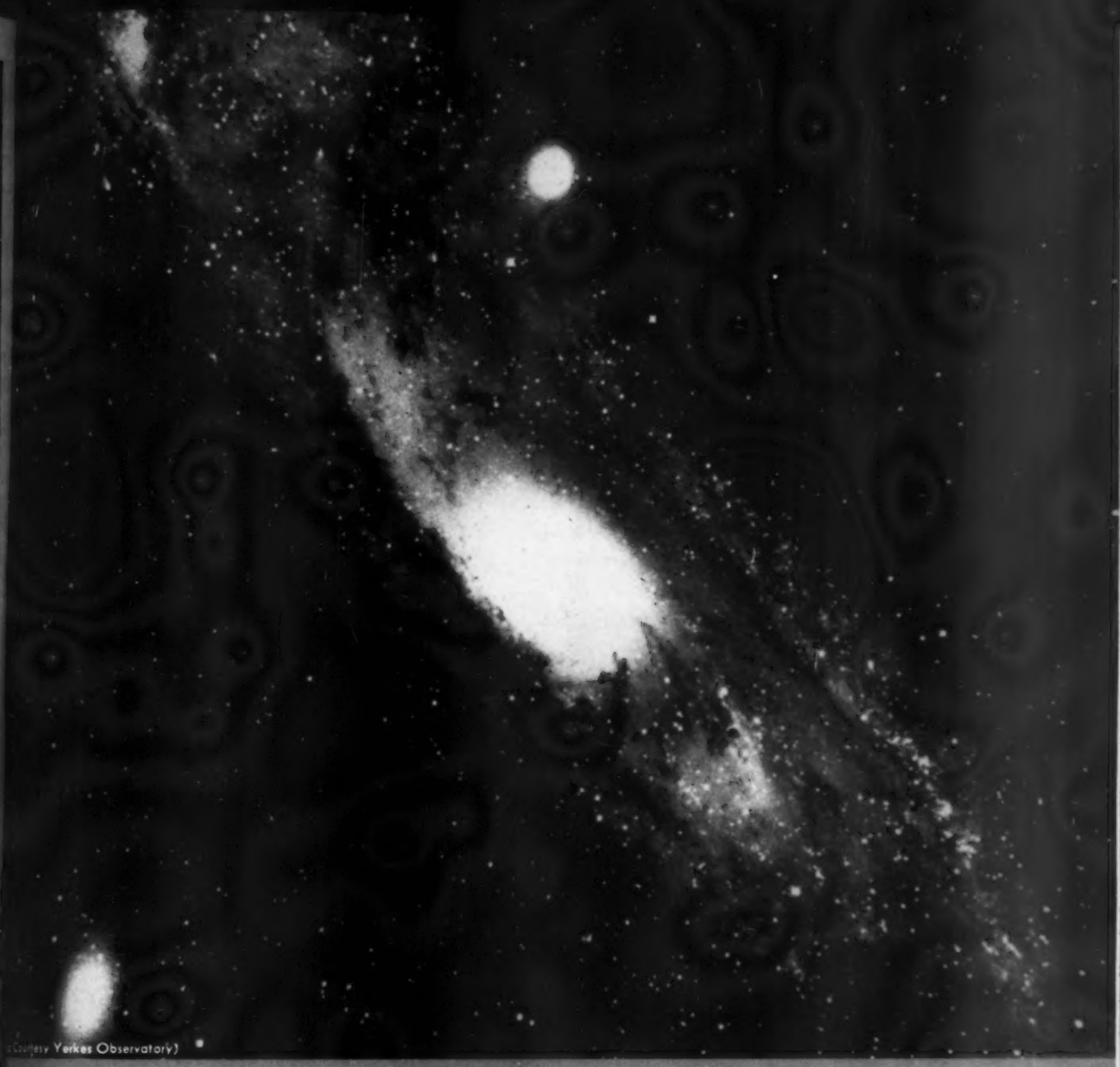
BACK THE ATTACK—BUY WAR BONDS
Defoe workers take more than 10% of their pay in War Bonds

DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.

Defoe

Ships for Victory
—Servants for Peace



(Courtesy Yerkes Observatory)

Clear Picture to the Strong Eye

HIGH DIELECTRIC STRENGTH

LOW MOISTURE ABSORPTION
CORROSION RESISTANCE

COMPRESSIVE STRENGTH

TENSILE STRENGTH

FLEXURAL STRENGTH

IMPACT STRENGTH

STABLE OVER A
WIDE TEMPERATURE RANGE

Many More Properties—Combined

THE Andromeda Nebula was just a blur in the sky until an inquiring mind and a telescope brought it into focus. Electricity was an awesome phenomenon until someone discovered how to use it. So it goes with all the unexposed realities in nature and science.

The future of plastics, in spite of already-known practical applications for them, is still a "blur in the sky." Engineers are getting a closer, sharper picture of what can and cannot be accomplished with them. The war has accelerated interest and action. But most of the work is ahead. The stimulus often, and logically, comes from the prospective user who knows his own requirements . . . from you, for example. If you'll write and tell us these requirements, we'll be glad to let you know, or find out, whether our type plastics will help.

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

Plan your present and future products with Synthane Technical Plastics

SHEETS • RODS • TUBES • FABRICATED PARTS

SYNTHANE

MOLDED-LAMINATED • MOLDED-MACERATED

SYNTHANE "Sandwich" Materials

One of the advantages of Synthane is the ease with which it can be bonded to other materials to produce a substance with the combined advantages of the partnership. Bonding takes place under heat and high pressure, during the polymerization of the Synthane; it is not a mere joining of two surfaces with an adhesive. The resulting combination, therefore, shows little or no tendency to delaminate.

Synthane combinations are familiarly known as Synthane "sandwich" materials, an appropriate name, for many different kinds of combinations are possible.

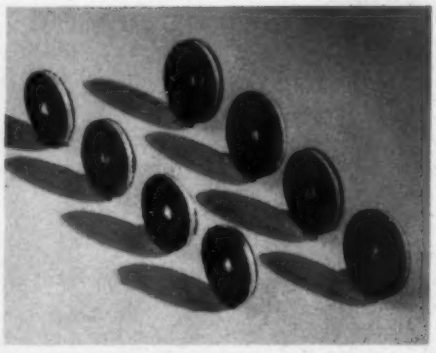
Probably the most widely used combination brings Synthane and rubber together.

Synthane-Rubber

Synthane-rubber combinations are advantageous where the strength of Synthane is desirable to back up rubber.

An interesting application concerns a washer used in electrolytic and oil type condensers. The washer is placed on the end of tin can electrolytic condensers with the Synthane face exposed to the chemicals to prevent deterioration. The can is crimped into the rubber to make a tight seal.

A similar washer is used on "bath-tub" condensers. Tough Synthane provides a firm seat for a nut which compresses the rubber to form a tight joint.



Combinations of rubber and Synthane have been furnished with rubber on one side, Synthane on the other; rubber on both sides with Synthane between; Synthane on both sides and rubber between; and alternate laminations of rubber and Synthane built up to any desired thickness.

There are many more possible uses for Synthane-rubber sandwich materials, which we cannot describe because of military censorship. There are also many important uses for a combination of Synthane and Neoprene.

Synthane-Synthane

Occasionally two grades of Synthane are combined. For instance, in certain radio tube sockets, layers of fabric

and paper base Synthane are combine The paper base has usually better ele trical properties while the fabric ba furnishes added strength where th stress is greatest.

Bobbin heads in the textile industry ar often made of paper and fabric bas combined. The fabric base endur rough handling, whereas the paper ba on the inside of the head provides smooth wearing surface.

Synthane-Asbestos

Synthane is wound about asbestos (o fibre) tubes and cured in the manufac ture of tubing for large fuse case Synthane adds strength and rigidity the fire resistance of the asbestos or fibr

Synthane-Other Materials

Synthane can be united with a variet of materials to produce a variety o practical combinations. We have mad or experimented with other combina tions. If you have any combination i mind which we have not explored, w will be glad to investigate its possi bilities for you.

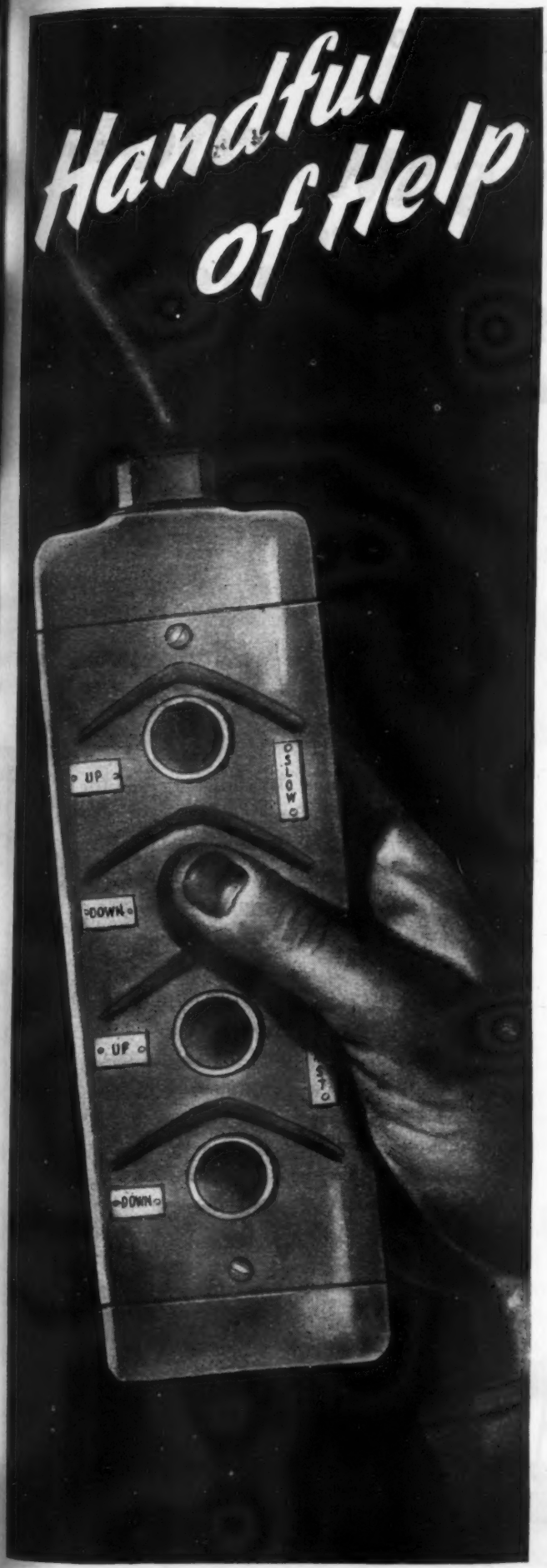
PLAN YOUR PRESENT AND FUTURE PRODUCTS WITH SYNTHANE TECHNICAL PLASTICS

SYNTHANE

SHEETS-RODS-TUBES-FABRICATED PARTS-MOLDED-LAMINATED-MOLDED

SYNTHANE CORPORATION, OAKS, PENNA.

REPRESENTATIVES IN ALL PRINCIPAL CITIES



FOR YOUR HOIST MANPOWER PROBLEMS

Make the most of your manpower. Move materials faster and easier with fewer men . . . with men who need not be "born" hoist operators—just average workers who have a job and try to do it well. To keep things moving right along whether Tom, Dick or Harry is on the job is what you want. And you get what you want with Robbins & Myers Push-Button Two-Speed Control.

Skilled or otherwise, the hoist operator has two speeds under precise push-button control. For slow speeds (4 to 6 feet per minute) he presses one button; for high-speed handling, another. He presses the button . . . no "fishing" around.

Learn, at first hand, how Robbins & Myers Hoists can give you precise, productive speed control . . . control that is geared to today's need for the simpler operating methods that spread available manpower as widely as possible. Clip, sign, and mail the coupon today for your free copy of "Electrical Details of Robbins & Myers Hoists."

ROBBINS & MYERS • Inc.

HOIST & CRANE DIVISION • SPRINGFIELD, OHIO

In Canada: Robbins & Myers Co. of Canada, Ltd., Brantford, Ont.

MOTORS • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

Mail This Coupon, Now!

ROBBINS & MYERS, INC. FM
Hoist & Crane Division, Springfield, Ohio

☐ Please send me new R & M 2-Speed Hoist Bulletin No. W815.

☐ Please have an R & M Hoist & Crane expert call on me.

Name..... *Dept*.....

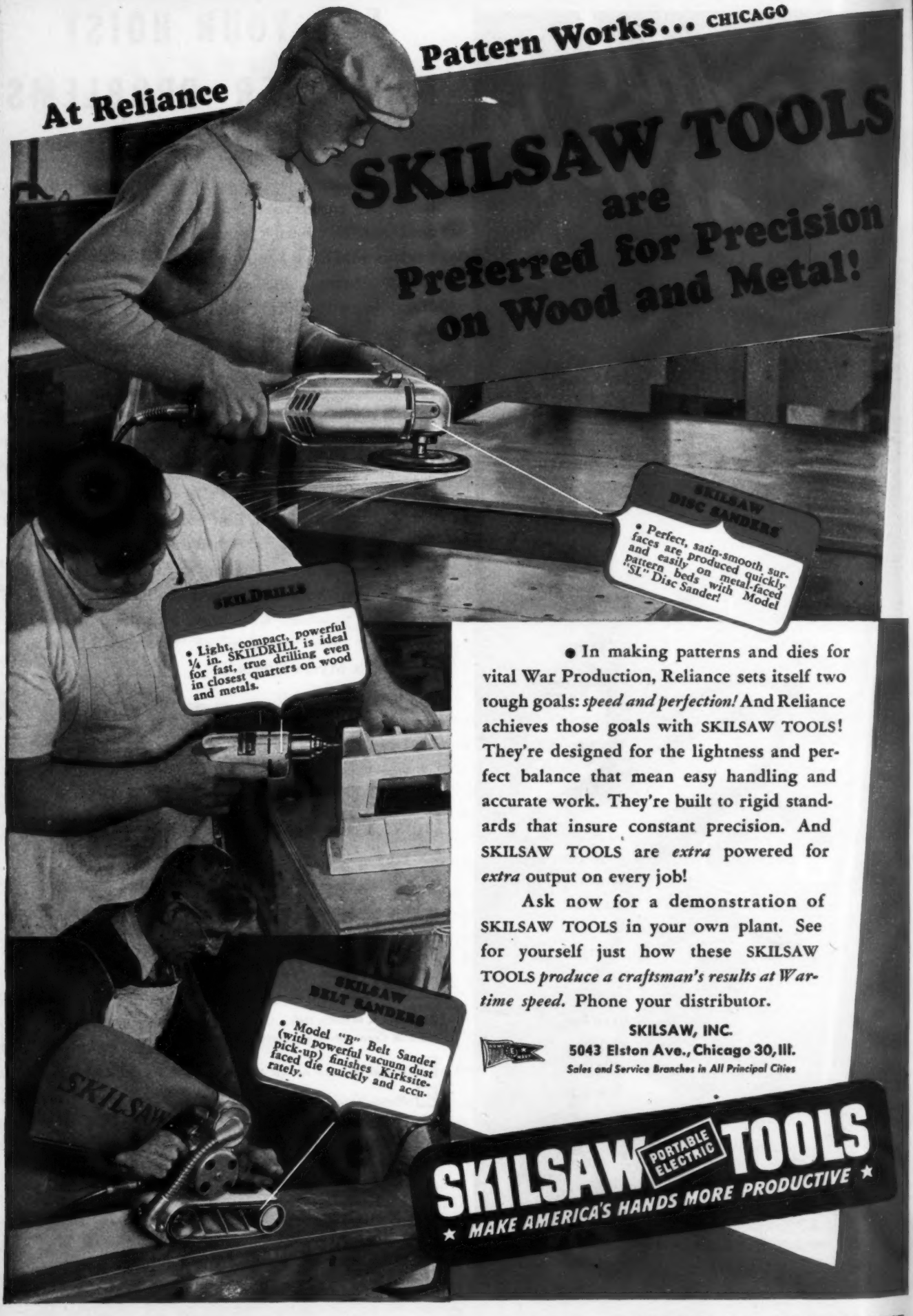
Company.....

Street Address.....

City..... *State*.....

At Reliance Pattern Works... CHICAGO

SKILSAW TOOLS are Preferred for Precision on Wood and Metal!


SKILDRILLS
• Light, compact, powerful ¼ in. SKILDRILL is ideal for fast, true drilling even in closest quarters on wood and metals.
SKILSAW DISC SANDERS
• Perfect, satin-smooth surfaces are produced quickly and easily on metal-faced pattern beds with Model "SL" Disc Sander!
SKILSAW BELT SANDERS
• Model "B" Belt Sander (with powerful vacuum dust pick-up) finishes Kirksite-faced die quickly and accurately.
SKILSAW

• In making patterns and dies for vital War Production, Reliance sets itself two tough goals: *speed and perfection!* And Reliance achieves those goals with SKILSAW TOOLS! They're designed for the lightness and perfect balance that mean easy handling and accurate work. They're built to rigid standards that insure constant precision. And SKILSAW TOOLS are *extra* powered for *extra* output on every job!

Ask now for a demonstration of SKILSAW TOOLS in your own plant. See for yourself just how these SKILSAW TOOLS *produce a craftsman's results at Wartime speed.* Phone your distributor.

SKILSAW, INC.
5043 Elston Ave., Chicago 30, Ill.
Sales and Service Branches in All Principal Cities

SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

HERE'S THE STORY...

FACTS AND FIGURES TO SOLVE YOUR SPEED VARIATION PROBLEMS

THE DIRECT CURRENT UNI-SHELL MOTOR

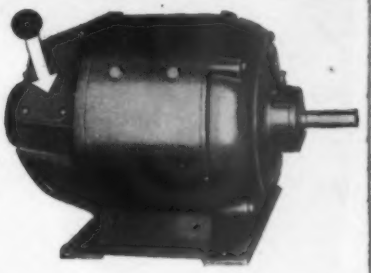
Completely modern, the new Robbins & Myers Uni-Shell Direct Current Motors combine ease of commutator and brush inspection with maximum mechanical protection. In performance, too, they offer real protection against high maintenance costs and time-wasting delays. All types, whether shunt or compound-wound, contain interpoles that assure long, trouble-free operation with good commutation and minimum brush and commutator wear.

In addition, you can enjoy the benefits of flexible mounting provided by Uni-Shell interchangeability. Shell length, diameter, base mounting holes, shaft dimensions, height of shaft above base, head fit, and bolt circle mounting for heads are exactly the same on these d.c. motors as on the a.c. types.

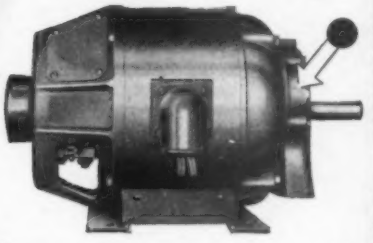
Get all the facts on profitable, protected d.c. motor application by asking for your free copy of the new, helpful, 20-page Uni-Shell Motors booklet, today.

ROBBINS & MYERS • INC.
MOTOR DIVISION, SPRINGFIELD, OHIO
HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

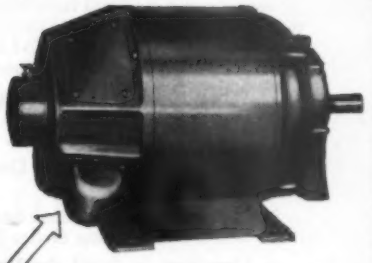
SHIPMENT NOW!
Ample stock on all types of integral motors on hand as this goes to press. Wire or phone your inquiry.



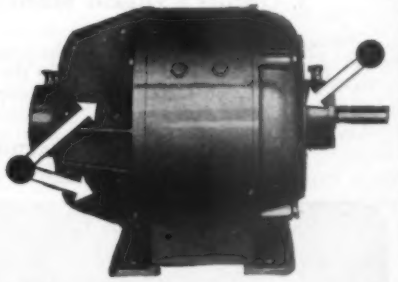
● **Open-type motor end head design guards against falling foreign material.**



● **Protected open-type made drip-proof by addition of cover plate to shaft-extension end of motor.**



● **Drip-proof type made splash-proof, too, by protective covers on bottom of end head.**



● **Totally enclosed type without ventilating openings in shaft-extension end head . . . plates on commutator end head cover both top and bottom openings.**

It's Free!

MAIL THIS COUPON NOW!

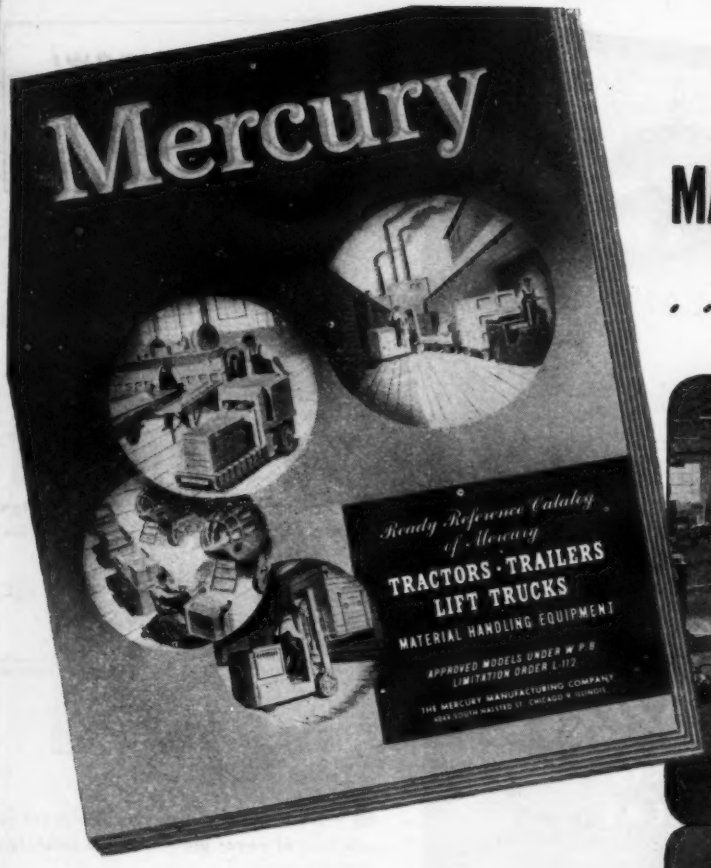
FM11

ROBBINS & MYERS, INC., Motor Division, Springfield, Ohio

Please send my free copy of the new, informative Uni-Shell Motors booklet.

Name.....*Dept.*.....
Company.....
Address.....
City.....*State*.....

I would ☐ would not ☐ like to talk to a representative.



Here's Help on Your MATERIAL HANDLING PROBLEMS

. . . *Present and Post-War*

TRACTORS · TRAILERS

PLATFORM LIFT TRUCKS

FORK LIFT TRUCKS

Whether your material handling interest is for present or post-war production, you can profit from a review of this new Mercury Bulletin No. 7-11. It quickly and concisely gives the following information:

1. When to use: Tractors and Trailers . . . Platform Trucks . . . Fork Trucks . . . the Fork Truck-"Trackless Train" System.
2. Explains the Do's and Don'ts of industrial truck operation.
3. Outlines the procedure for ordering trucks under W.P.B. Limitation Order L-112 & L-112-a.
4. Describes in detail the Mercury equipment available under W.P.B. Limitation Orders and explains deliveries.
5. Contains a valuable Material Handling Bibliography.

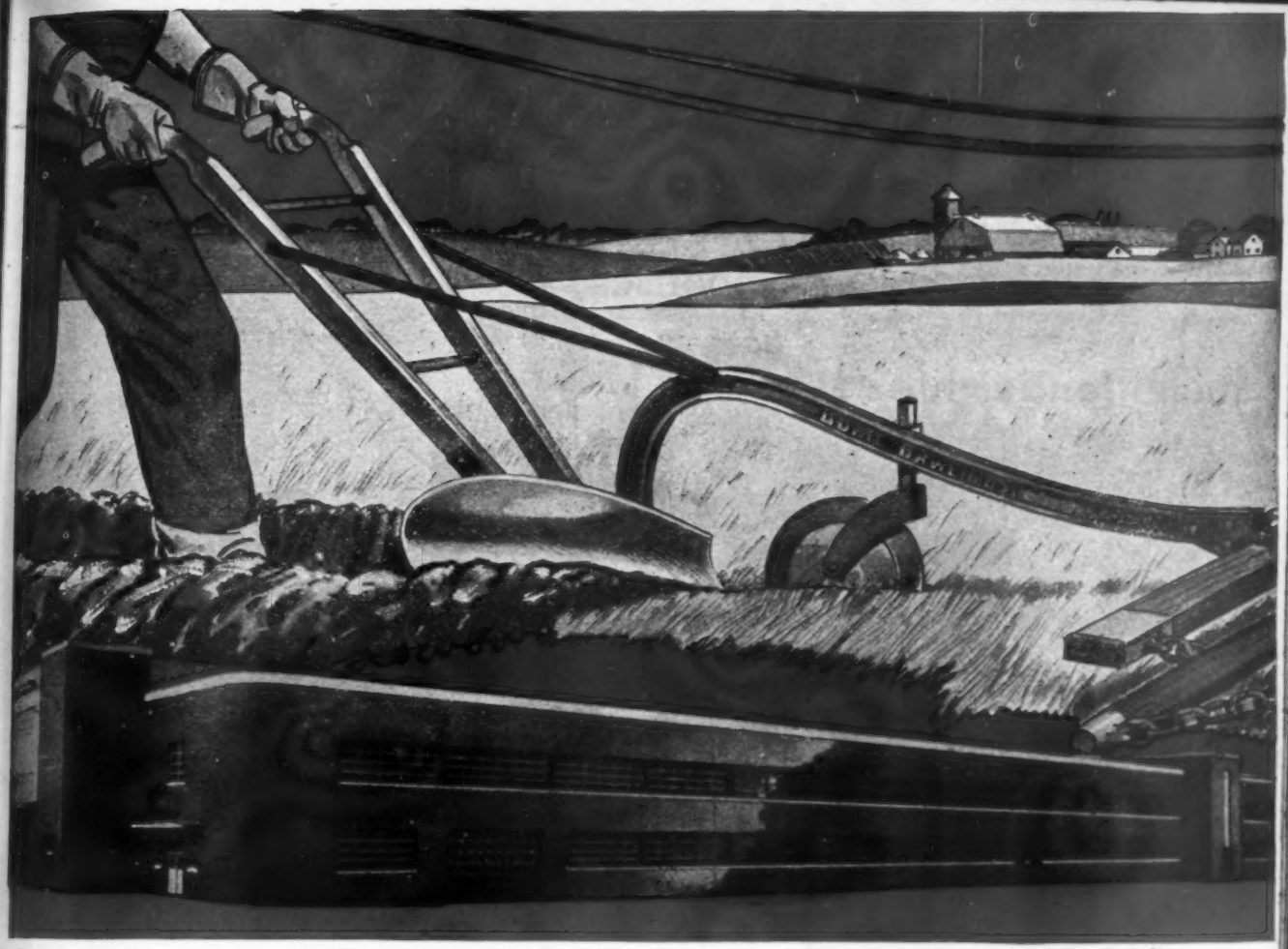
These are but highlights of the wealth of helpful information you will find contained in the new Mercury Bulletin No. 7-11. To secure your free copy, write on your company letterhead.

THE MERCURY MANUFACTURING COMPANY
4110 SOUTH HALSTED STREET • CHICAGO 9, ILLINOIS

FORK TRUCK-"TRACKLESS TRAIN" SYSTEM

MERCURY

TRACTORS • TRAILERS • LIFT TRUCKS



More than a quarter million dollars plowed back to American industry

by One Allen Ventilating Unit . . .

Ventilation that does the job comes first with Allen. Close on the heels of that consideration comes lowered cost to the buyer. Only when we click on both are we satisfied, because only then do we know we've done the right kind of job.

Basically better ventilation engineering has enabled Allen to furnish industry with more than four thousand Allen Type "H" Roof Fans at an average saving of $62.50 per unit over the nearest comparable equipment—more than a quarter million dollars.

The explanation is simple. Allen patents cover the use of dampers balanced in the effluent air stream—open when the fan is running, closed automatically when power is off. This is in contrast to construction used by several other manufacturers wherein mechanical, motor-operated dampers are mandatory and up the cost.

Approximately 400 of these Allen units top the huge Willow Run Bomber Plant, shown above. Allen has an answer for your ventilation problem, too, whether it's ordinary or extraordinary. Let's talk it over. *The Allen Corporation, 9751 Erwin Avenue, Detroit 13, Michigan.*

SOME TYPICAL USERS OF ALLEN TYPE "H" UNITS

BLACK AND DECKER
BOWER ROLLER BEARING
BUNDY TUBING COMPANY
EX-CELL-O CORPORATION
FISHER BODY DIVISION
FORD MOTOR COMPANY
GENERAL ELECTRIC COMPANY
DES MOINES ORDNANCE PLANT
TWIN CITIES ORDNANCE PLANT
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SERVEL, INCORPORATED
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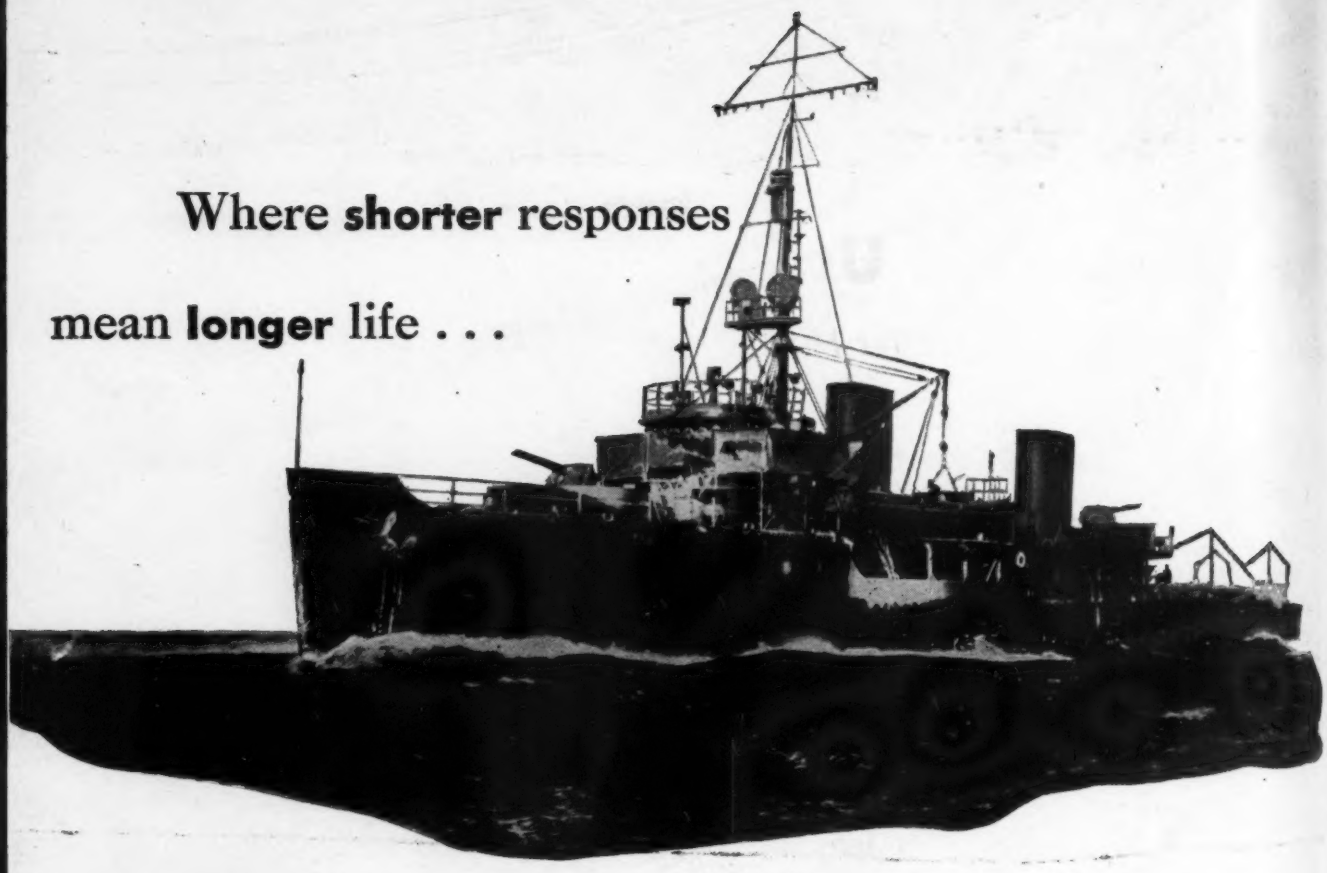
GAR WOOD INDUSTRIES

THE *Allen* CORPORATION

ENGINEERED VENTILATION FOR INDUSTRY

Official U. S. Navy Photo



Where **shorter** responses mean **longer** life . . .

W·A·B *controls are serving*

Clearing the way in amphibious landings—breaking trail for battleships, carriers, cruisers, and destroyers—riding herd on convoys and doing anti-submarine work—minesweepers have a job second only to submarines in the hazards encountered. Precise and immediate response to the orders of the bridge may often mean the safety of the vessel, and the success of a mission. W·A·B Controls are now serving on a number of minesweepers.

* * * *

The marine field is only one of many where W·A·B Controls are helping or can help to solve difficult control problems. The job the controls are doing here gives an excellent picture of their possibilities, and may suggest places where they can serve for *you*.

W·A·B Control Systems for ships concentrate command of all engine maneuvering in small, compact stations, located on the bridge . . . in the engine room . . . or both. The entire cycle of engine maneuvering . . . speed control, clutching, braking and reversing . . . is governed by the movement of a small handle. Load balancing and synchronization of multiple-engine drives is simplified, simple interlocks prevent damage to equipment through operating errors.

If your post-war planning for your plant or your product requires a safe, simple, completely dependable control, it will pay you to investigate W·A·B Controls.

Westinghouse Air Brake Company

INDUSTRIAL DIVISION

General Offices: Wilmerding, Pa.

75 Years of Pneumatic Control Experience

WAB

Pneumatic . . . Pneumatic-Electric . . . Pneumatic-Hydraulic

control systems

NOW AVAILABLE!

for Permitted Uses

as per WPB Amended Order M-1-g

RESTRICTIONS on the use of aluminum pigment are now relaxed by order of WPB. This means that the economy and special protective advantages of PERMITE Ready-Mixed Aluminum Paint are again available for a broad list of industrial uses, which carry an order rating of AA-5, or higher.

Aluminum paints may now be supplied on orders of such rating for interior use in industrial plants and for industrial equipment, where excessive moisture, fumes or temperatures prevail . . . for interior surfaces of dairies, milk bottling plants, and food processing plants . . . for outdoor storage tanks for petroleum products and volatile chemicals — according to the WPB amended order.

Other permitted classifications listed include use "in the manufacture, maintenance or repair of combat products complete for tactical operations when they are being produced for or used by U. S. Army, Navy, Maritime Commission or War Shipping Administration . . . "

Permite Aluminum Paints come to you ready to open and use. No messy, time-wasting mixing; no loss of color after can is opened. You get true painting economy . . . extra coverage . . . extra protection against corrosion, heat, cold, moisture and other destructive agents.

Write Today for copy of WPB Amended Order M-1-g giving **complete list** of permitted classifications for use of aluminum paint.

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio

Distributors in Principal Cities

The Permite Line of Industrial Finishes includes Permite Government Specification Paints for War Production use.

PERMITE READY MIXED ALUMINUM PAINTS

But-THERE IS A BETTER MEANS THAN THE SHADOOF

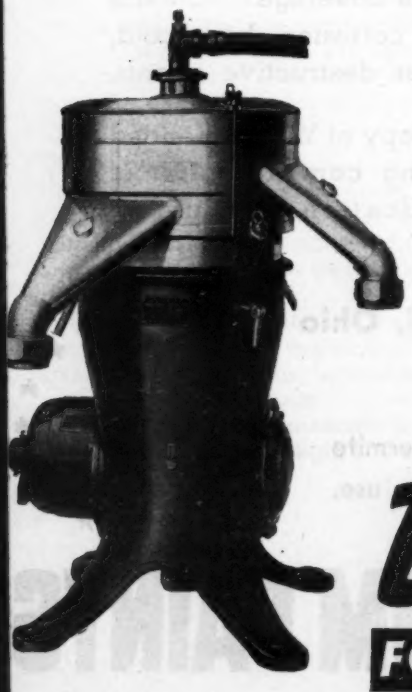
Bowls of most De Laval centrifugal machines are of the "constant efficiency" type—the degree of separation or clarification is not affected by the removed sediment, which accumulates outside of the zone of separation.

THE ancient shadoof has given way to the pump in most parts of the world, because the shadoof is no longer the *best* way of drawing water from the earth. But in too many factories, almost equally primitive and inefficient methods of keeping oil in usable condition are still practiced . . . chiefly because they "work"—after a fashion—even though there may be a much better way of maintaining the oil.

The modern, efficient method of purifying factory oils, or of removing solid impurities from oil, is by means of a De Laval Oil Purifier. Utilizing centrifugal force in place of gravity (or any other inefficient method, such as a filter), these machines purify oil *instantaneously* and continuously, removing even the smallest particles of dirt, abrasive and grit, as well as water.

Oil or coolant centrifuged in De Laval Purifiers or Clarifiers can be used over and over again, for the De Laval method of purification or clarification most fully restores "new-oil" qualities. Moreover, waste of oil and loss of productive time is eliminated by their use.

Write for Bulletin FF, "De Laval Purifiers for Factory Oils." Sent free.



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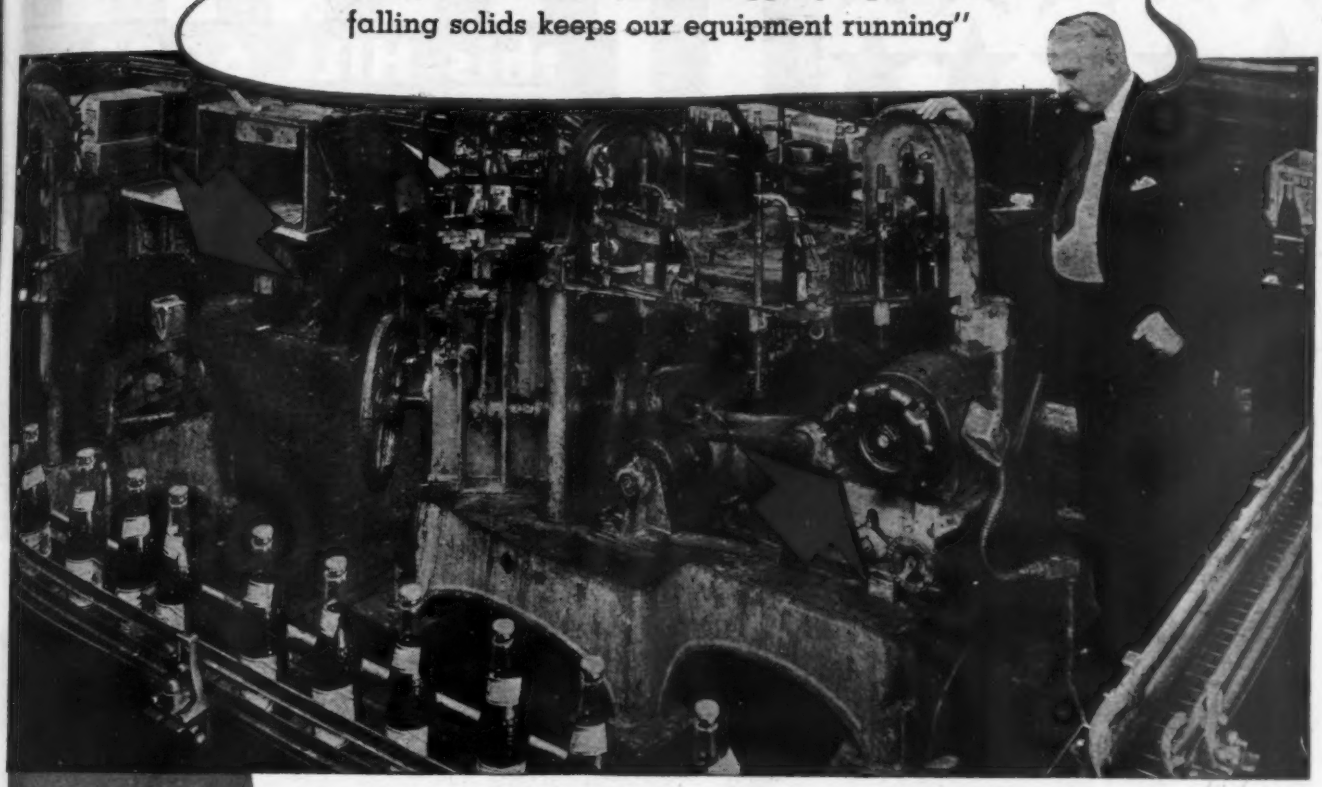
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL CENTRIFUGAL OIL PURIFIERS AND CLARIFIERS

FOR ALL TYPES OF FACTORY OILS

Take a Look at TOMORROW— *Today!*

"Century Protection against dripping liquids and falling solids keeps our equipment running"



DON'T RISK PRODUCTION STOPPAGES— Specify Century SPLASHPROOF MOTORS

for Protection Against:-

- ✔ Dripping Liquids
- ✔ Falling Solids
- ✔ Plant Washdowns

You can depend on Century Motors to give you long, continuous, economical service even though subjected to unfavorable operating conditions. They stand up under rain, snow, sleet, or ice when outside, as well as falling or splashing liquids when inside.

In addition to the well-designed frame and end brackets that keep out liquids, Century windings are well insulated against the moisture that would prevail in an installation such as shown above. Special insulations are available for applications where the air is charged with abnormal concentrations of acids, alkalies, or steam.

The Century Splashproof Motor is but one example of the wide variety of Century Motors, from fractional to 600 horsepower. Remember Century Motors for today's requirements and tomorrow's plans. Protect your production with Century Splashproof Motors.

CENTURY ELECTRIC COMPANY

1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

347

What part will machine tools play in helping to take this HILL 609?

In the barren wastes of Tunisia stands a lonely promontory. It had no name—until, in a brief hour of history, the courage of men immortalized it with a number . . . 609.

We, too, have yet to conquer a barren promontory—barren of hope, of light, of the freedom men are fighting for. This hill is held by poverty, armed with ignorance, intolerance and fear. It is our own Hill 609, in Detroit, in Harlem, in Los Angeles—in a thousand places here at home.

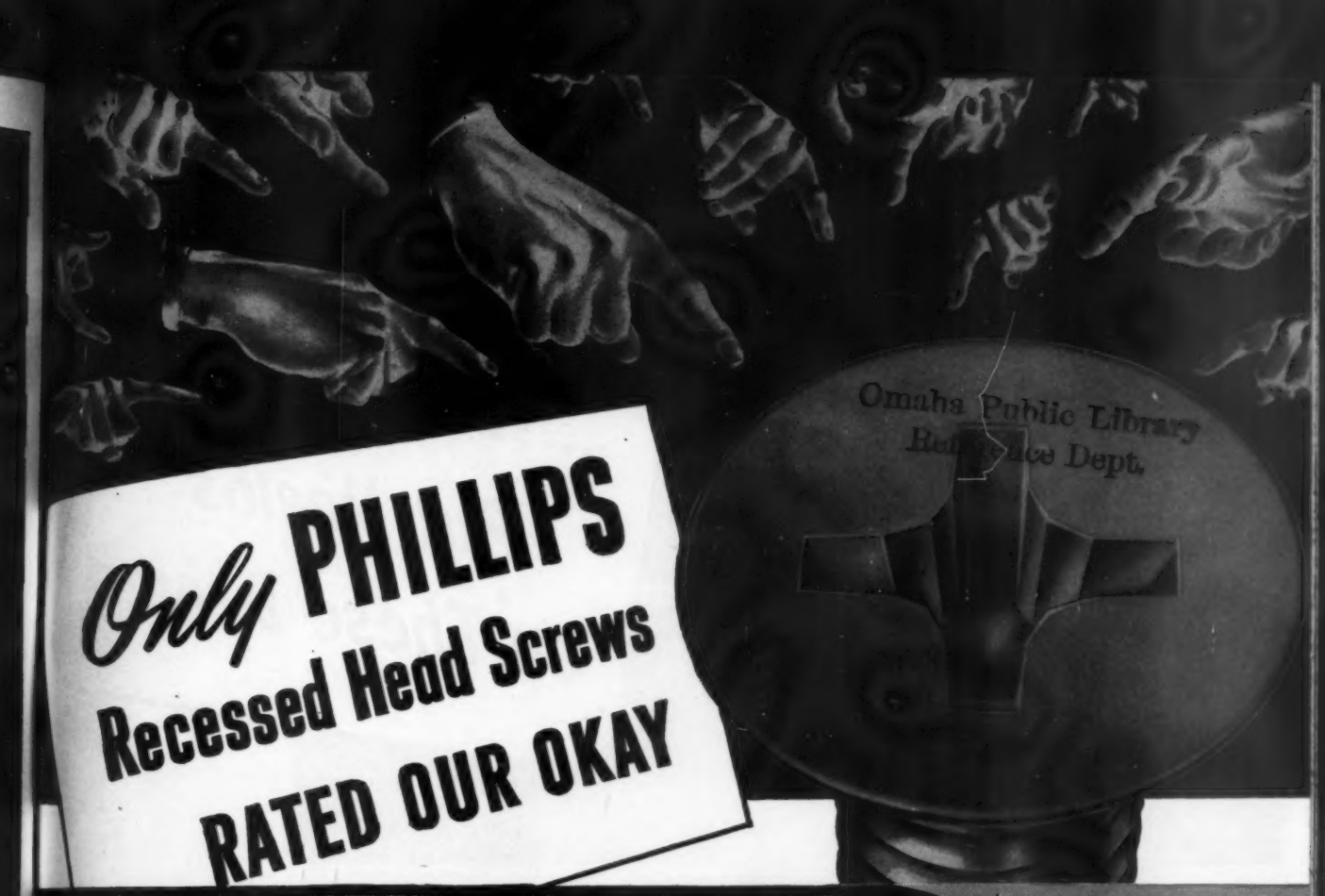
What part will machine tools play in taking *this* Hill 609? The whole part. Machine tools at work. Machine tools building a better standard of living than even we have ever dreamed of before.

For there is scarcely an essential to better living—from the windows men look through to the most intricate and wonderful machines that help them to think, to search and see light—that does not stem from a handful of basic machine tools.

And one of these—the internal grinding machine—is essential to the creation of literally *everything* that will make for a better living after this war.

BRYANT

BRYANT CHUCKING GRINDER COMPANY SPRINGFIELD VERMONT, U.S.A.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Reference Dept.

Only PHILLIPS Recessed Head Screws RATED OUR OKAY

...say 23 Leading Screw Manufacturers

FOR YEARS, leading screw makers tested ideas for recessed heads. All showed design faults. Then came the Phillips Recess. Unanimously, these makers agreed that here, at last, was the answer they'd been looking for . . . a scientifically engineered recess, *right* in every respect.

And practically the entire screw industry adopted it!

There's nothing exactly like the Phillips Recess. It's the only screw recess in which every angle, every dimension has a purpose—plays a definite part in screw driving efficiency and fastening strength.

That's why it pays to specify screws with Phillips Recessed Heads. You can get them in any head style, type, or size.

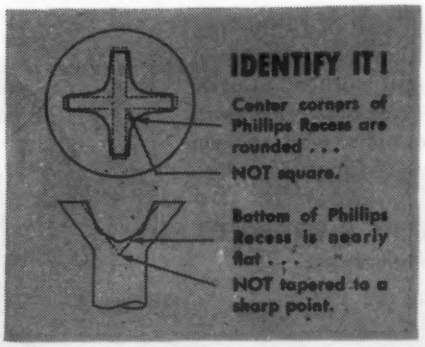
TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

FASTER STARTING: Driver point automatically centers in the Phillips Recess . . . fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

FASTER DRIVING: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

EASIER DRIVING: Turning power is fully utilized. Workers maintain speed without tiring.

BETTER FASTENING: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.


IDENTIFY IT !
Center corners of Phillips Recess are rounded . . .
NOT square.
Bottom of Phillips Recess is nearly flat . . .
NOT tapered to a sharp point.

AMERICAN SCREW CO.
Providence, Rhode Island
THE BRISTOL CO.
Waterbury, Connecticut
CENTRAL SCREW CO.
Chicago, Illinois
CHANDLER PRODUCTS CORP.
Cleveland, Ohio
CONTINENTAL SCREW CO.
New Bedford, Massachusetts
THE CORBIN SCREW CORP.
New Britain, Connecticut
GENERAL SCREW MFG. CO.
Chicago, Illinois
THE H. M. HARPER CO.
Chicago, Illinois
INTERNATIONAL SCREW CO.
Detroit, Michigan
THE LAMSON & SESSIONS CO.
Cleveland, Ohio
MILFORD RIVET AND MACHINE CO.
Milford, Connecticut
THE NATIONAL SCREW & MFG. CO.
Cleveland, Ohio
NEW ENGLAND SCREW CO.
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PARKER-KALON CORP.
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PAWTUCKET SCREW CO.
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Chicago, Illinois
READING SCREW CO.
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RUSSELL BURDSALL & WARD BOLT & NUT CO.
Port Chester, New York
SCOVILL MANUFACTURING CO.
Waterville, Connecticut
SHAKEPROOF INC.
Chicago, Illinois
THE SOUTHINGTON HARDWARE MFG. CO.
Southington, Connecticut
WHITNEY SCREW CORP.
Nashua, New Hampshire

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS
MACHINE SCREWS
SELF-TAPPING SCREWS
STOVE BOLTS

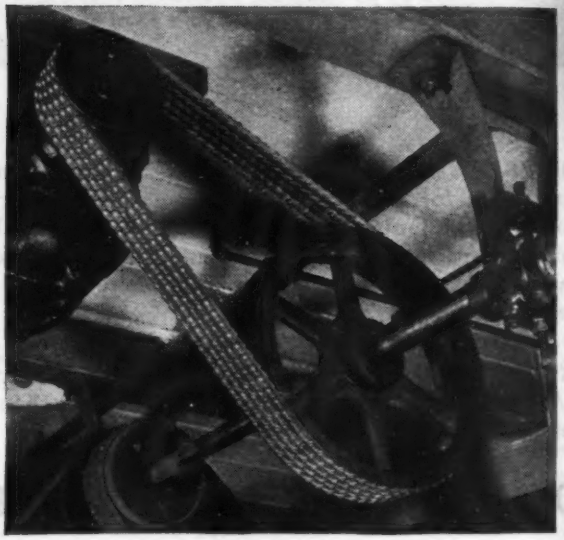
"EASE OF INSTALLATION
...SAVING OF TIME"

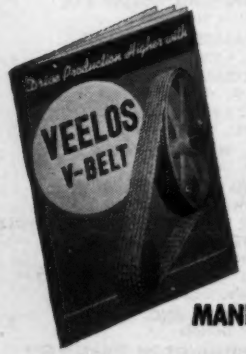
Put Veelos on These Drives

ASKED why he chose Veelos for lineshaft drives of a company among the leaders in its field, the Chief Engineer gave these reasons: (1) "ease of installation" and (2) "saving of time."

Thousands of Veelos installations are proving that the Chief Engineer was right because:

1. *"EASE OF INSTALLATION."* Any desired length of Veelos—the link V-belt—can be uncoupled from an economical stock roll in less than 60 seconds... and, in another minute, can be coupled endless and installed on any drive.





2. *"SAVING OF TIME."* With Veelos in rolls, V-belts can be replaced in a few minutes... reducing machine downtime.

These are just two of twelve important production advantages of Veelos. Check on the others... *write today for free 8-page illustrated manual* giving applications, construction detail, installation directions, engineering data.

MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

VEELOS
THE LINK
V-BELT
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

A Completely Equipped Foundry has been added to Brake Shoe's Research Group

Vital war work demanded a full-scale foundry for experimental castings.

Such castings might be piloted in a production plant, but this would interfere with regular work.

Today this full-scale experimental foundry is ready for operation as part of Brake Shoe's Research Group.

To house this foundry, an unused factory building had to be dismantled and moved from Kansas City, Kansas, to Mahwah, New Jersey.

If engineers can take new ideas in foundry practice direct to the foundry and get all the kinks out before going into regular production . . .

It should effect important time savings.

It should accelerate necessary field testing and develop improved methods.

In addition to current concentration on problems directly connected with wear, experienced metallurgists and engineers of this Research Group are constantly working to improve products and production methods.

If you have a "punished part" problem, either in the structural or production phase, Brake Shoe's expanded research facilities should be helpful. They are available to manufacturers whose production calls for large runs of standardized parts.

Is Brake Shoe On Your Parts Source List?

Because many of the millions of parts produced by Brake Shoe for war have equally important peacetime uses, Brake Shoe will be ready for parts assignments in volume, the moment victory is won.

American Brake Shoe Company, 230 Park Avenue, New York 17, New York

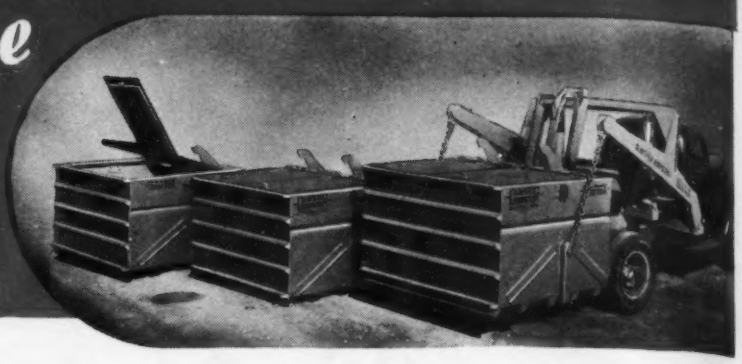
AMERICAN **Brake Shoe** COMPANY

Brake Shoe's Research Group
1. Engineering Laboratory
2. Metallurgical Laboratory
3. Experimental Foundry

8 DIVISIONS, 69 PLANTS SERVING INDUSTRY AND TRANSPORTATION

American Brakeblok Division . . . . . Detroit, Mich.	Brake Shoe and Castings Division . . . New York, N. Y.
Ramapo Ajax Division . . . . . New York, N. Y.	American Forge Division . . . . . Chicago, Ill.
American Manganese Steel Division, Chicago Heights, Ill.	Southern Wheel Division . . . . . New York, N. Y.
Kellogg Division . . . . . Rochester, N. Y.	National Bearing Metals Corp. . . . . St. Louis, Mo.

They spot them throughout the plant



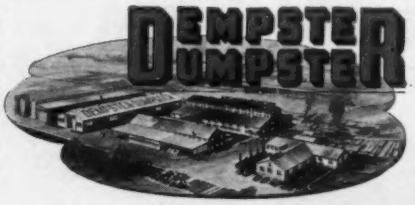
Another Dempster Development For Industrial Materials Handling

★ Another typical example of how the Dempster-Dumpster is saving time, manpower, trucks, tires, and gas in leading industrial plants of almost every classification.

In this case, twenty standard Dempster-Dumpster drop-bottom bodies of 6 cu. yd. capacity each, equipped with special twin, self-balancing, spring hinged tops, are spotted throughout one of America's most vital war factories. A few are placed in convenient spots for receiving waste and rubbish. Others are placed at strategic points for recovering metal shavings. As each body is filled, forked truck conveys loaded body to convenient point where truck, equipped with the Dempster-Dumpster Hoisting unit, hoists load to carrying position, and dumps it at delivery point, all under full control from driver's seat. When empty body is returned, another loaded one, perhaps with a different type of material, is there for hauling and dumping . . . an uninterrupted cycle of materials handling using twenty bodies but with only one truck.

In dozens of other plants, various types of bodies are in use handling materials of almost every description from dust to liquid . . . light to heavy up to 7½ tons pay load . . . finished and unfinished products . . . hot materials up to 1500 degrees F . . . and in every operation with one truck serving from 6 to 50 bodies.

The chances are that the advantages of the Dempster-Dumpster can and should be adapted to your plant. Let our engineers cooperate with you. Write for our complete operating manual No. 242 now.



Illustrations on this page tell the operating story of the Dempster-Dumpster.

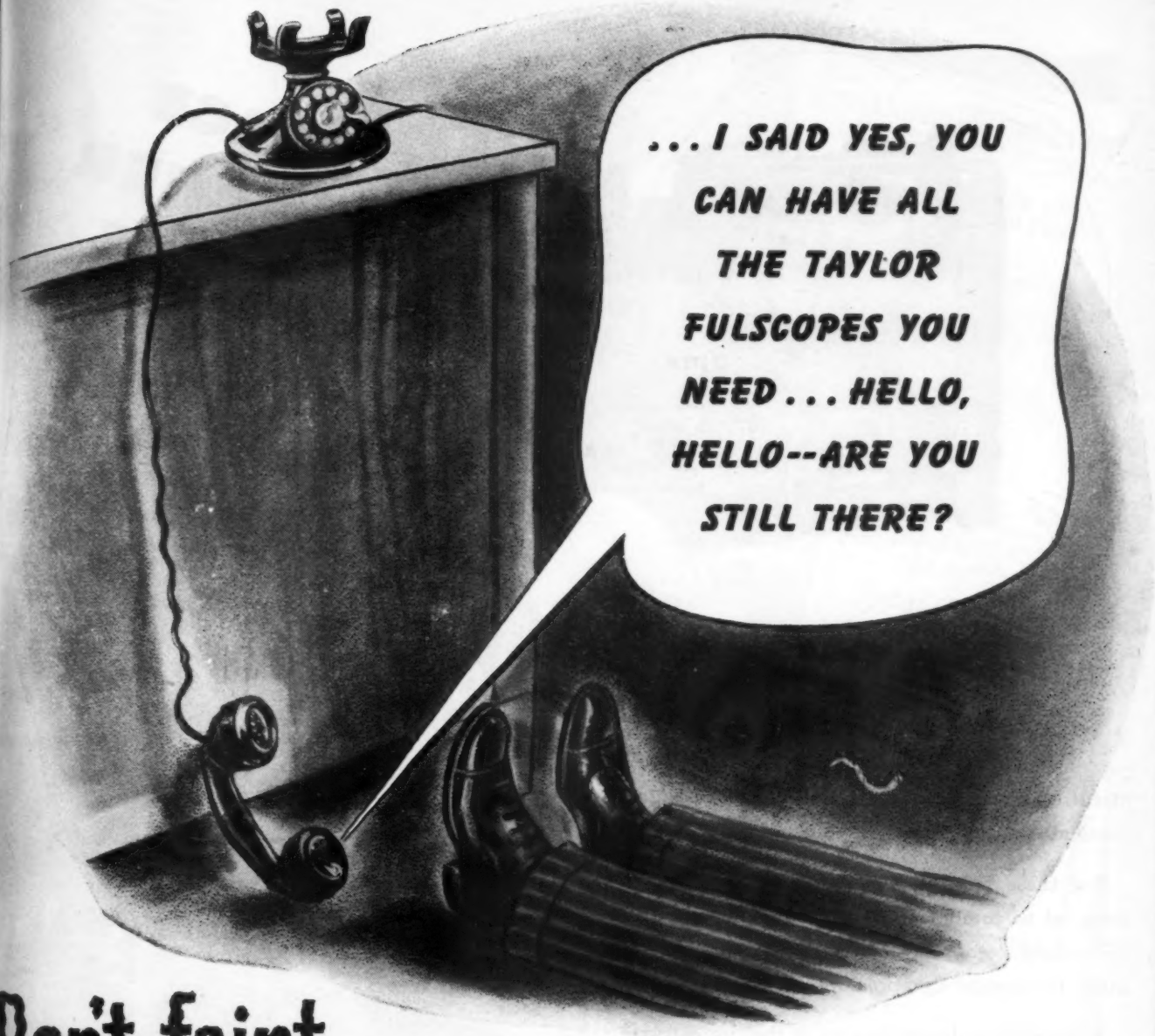
Top right shows a loaded body ready for hoisting. Shown also in this photo is the special twin, self-balancing, spring hinged tops on this particular body.

Center Photo shows loaded body in carrying position.

Bottom Photo illustrates instant, or controlled, dumping method of the Dempster-Dumpster bottom-dumping type of body.

Types of bodies available are unlimited. Your requirements determine the design. Cooperation of our engineers with those of the customer has corrected hundreds of materials handling problems and at tremendous savings.

Dempster Brothers, Inc., 224 Springdale, Knoxville 17, Tennessee



Don't faint when we tell you that we're ready for new orders on Taylor Fulscope Controllers. It's true!

For a year and a half we've been working at top speed to fill orders for instruments for high octane gasoline, synthetic rubber, alcohol and many other top-priority war needs. As a result of this, we've expanded and streamlined our production facilities to the point where we can actually get back to normal delivery schedules once more!

If you need Taylor Instruments for "cat" cracking, isomerization, alkylation, dehydrogenation, or any other continuous process, *call your Taylor Field Engineer.* Or write or wire the Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.

TAYLOR REPAIR SERVICE. We can now give the same prompt service as on new instruments. We have complete repair facilities at Rochester, Tulsa, and San Francisco, also in Toronto.

ARMY E NAVY

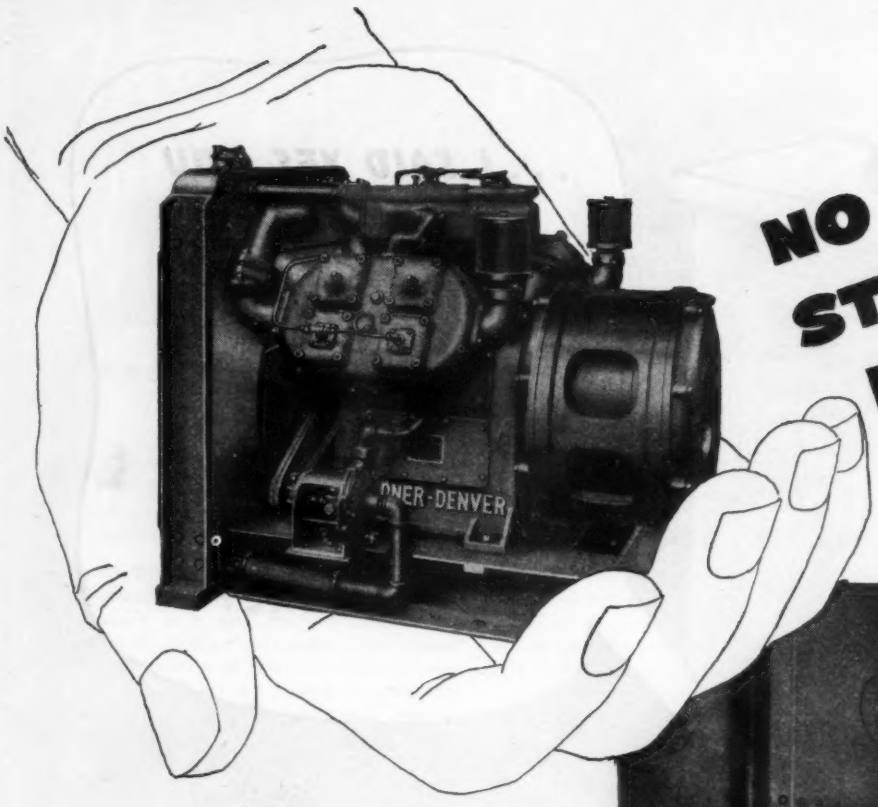
Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

★ KEEP ON BUYING U. S. WAR BONDS AND STAMPS ★



NO SPACE STRETCHER NEEDED!

You don't need a "space stretcher" when you install a Gardner-Denver "WB" Two-Stage Vertical Air Compressor in your plant.

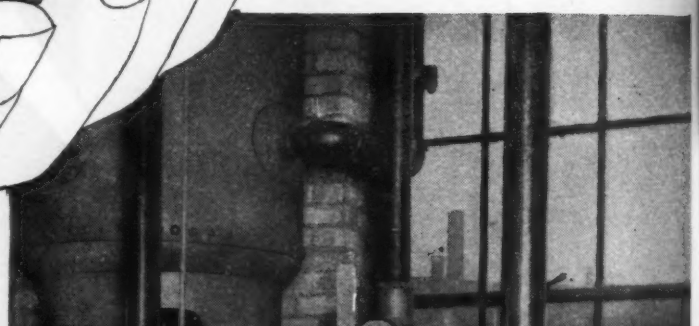
For these Gardner-Denver Compressors are designed to combine unusual compactness with air output comparable to that of large Two-Stage Horizontal Compressors.

A distinctive design feature is the use of two small-diameter, low-pressure cylinders in conjunction with each high-pressure cylinder . . . instead of a single large one . . . permitting the use of small, lightweight pistons in all cylinders.

Thus, the inertia load is reduced, making possible considerable reduction in compressor size.

Note These Design Advantages

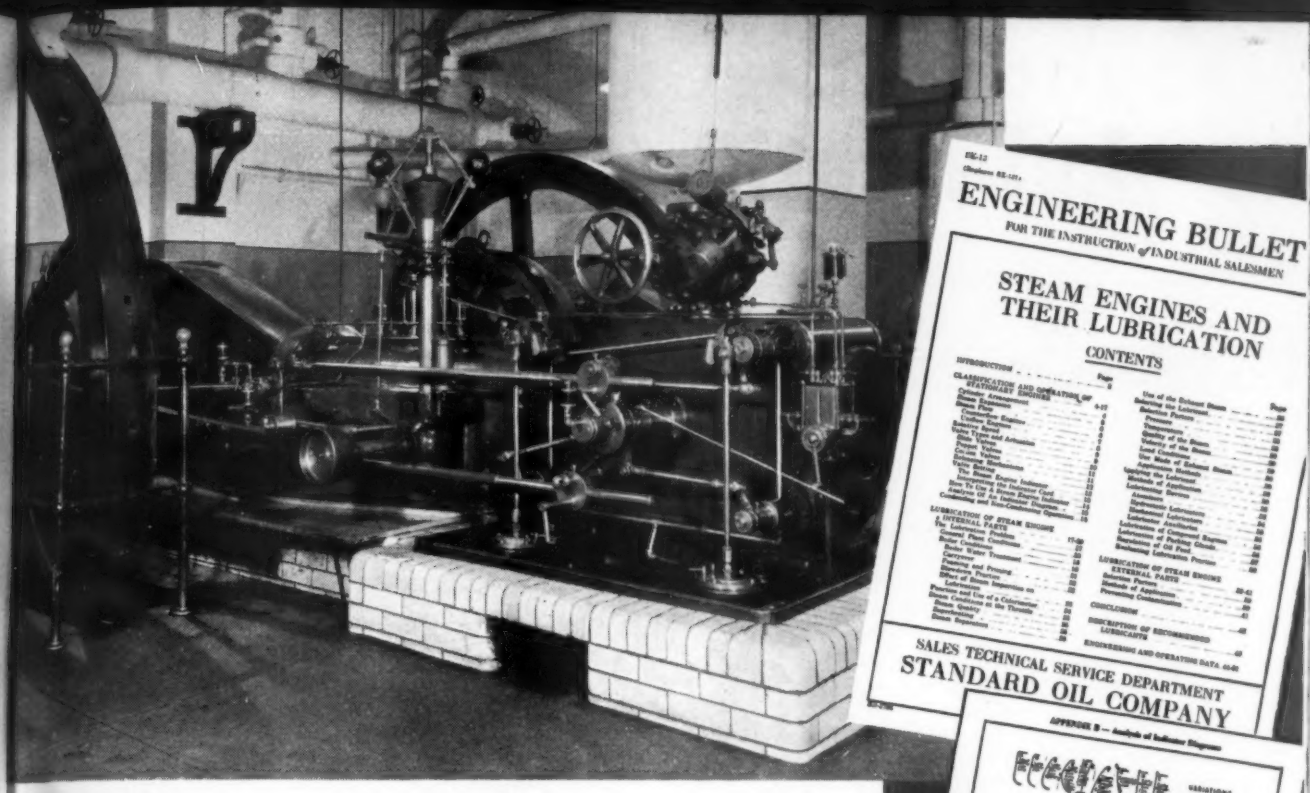
1. Fully water-cooled cylinders for lubricating oil economy and lower discharge temperatures. A self-contained unit as far as cooling water is concerned . . . no outside water piping required.
2. Extra strength and hardness assured by GarDurloy—the special high-strength alloy iron.
3. Drop-forged crankshafts mounted on Timken roller main bearings.
4. Capacities ranging from 142 to 445 cubic feet displacement per minute.

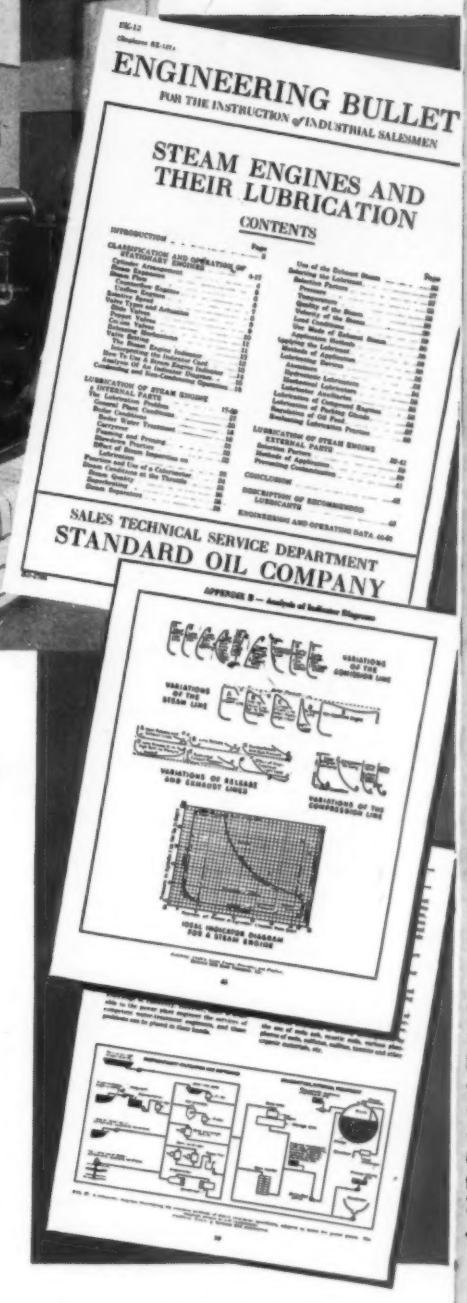


Since 1859

GARDNER-DENVER

For complete information on Gardner-Denver "WB" Compressors, write for illustrated bulletins. Gardner-Denver Company, Quincy, Ill.





To help steam engines do a wartime job

• RECOGNIZING the huge overload that many steam engines are carrying in this critical period and the absolute necessity of keeping those engines operating most satisfactorily, Standard Oil now offers this up-to-the-minute Engineering Bulletin on "Steam Engines and Their Lubrication."

This bulletin was written by engineers as a manual of information for our own industrial service representatives. It is made available now to power plant men because of the helpful information it contains for men new on the job and because of the increased importance of steam engine lubrication to all operators.

If your plant is located in the states listed, you can get copies of this bulletin by asking your Standard Oil Man or writing Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 5, Illinois. In Nebraska, write any Standard Oil Company of Nebraska office.

COLORADO • ILLINOIS • INDIANA • MISSOURI
KANSAS • MICHIGAN • MINNESOTA • IOWA
MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

If you have a specific problem in steam engine lubrication, ask to have a Standard Lubrication Engineer call at your plant. His suggestions may help you save vital parts or stave off unnecessary shutdowns. His service will cost you nothing.

Send for this bulletin. "Steam Engines and Their Lubrication" discusses such subjects as steam conditions and their relation to lubrication, analysis of indicator diagrams, and methods of oil atomization. It may help to clear up specific troubles you are now having.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

•LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBRICATION ENGINEERING•••LUBR

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Lubrication *News* letter

Practical suggestions from the field on how Lubrication Engineering and lubricants are being used by midwest operators to lick tough wartime jobs.

FEBRUARY, 1944

Compressor fire hazard reduced. Excess oil in the receiver of multi-stage compressors is never desirable—it can be dangerous. When heavy loads, long hours of operation, or faulty cooling units allow operating temperatures to rise it presents a definite fire hazard.

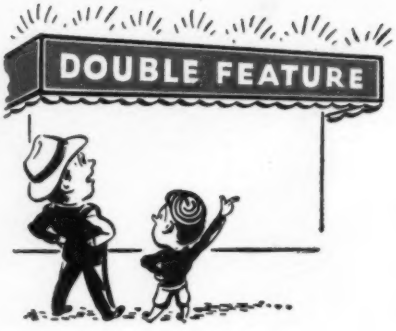
A Michigan war plant found it out the hard way—by experience. After one or two "experiences" which left no doubt that something had to be done, a Standard Lubrication Engineer was called in. He made three suggestions:
1. Lower intake air temperatures.
2. Lower cooling water temperatures in the after-coolers. This not only cools the air, but also condenses oil vapor before it is carried over into the receiver.
3. Lastly, but of first importance, use a better oil so that less is needed to secure adequate lubrication.

In this case Stanoil 31 was the answer. After three months' use there has been no recurrence of receiver fires, and oil consumption has been reduced 50% with adequate lubrication of the compressors.

P. S. to the above. As an added attraction, Stanoil and the Lubrication Engineer also cured a long standing problem on this Michigan plant compressor. Windings on the compressor motor were oil soaked. The Engineer pointed out that Stanoil's high V. I. (viscosity index)—a quality which prevents it from thinning out excessively when temperatures go up—would keep the oil *in* the motor bearings and *off* the windings. It did just that. The saving in maintenance this made was almost as important as the 50% saving in oil consumption mentioned above.

Two reasons why some Hydraulic Oils go bad—and Stanoil doesn't

Viscosity increase and acidity are two signs of deterioration in hydraulic oils. Either may make hydraulic oils unfit for further use.



An excessive increase in viscosity makes operation sluggish in most hydraulic systems. High oil acidity causes deposits, oil discoloration, and poor separation from water which may result in foaming and erratic operation if there is moisture in the system.

Stanoil is made to reduce both of these troublesome causes of hydraulic oil failure, not just in laboratory tests but in actual service. For example, a Lansing, Michigan plant uses a large quantity of hydraulic oil. Because of this an accurate check is maintained on oil condition. Records from this plant show a typical sample of Stanoil No. 18 after 2392 hours of almost continuous operation to have the same viscosity as unused oil, and a neutralization number of only 0.15. Stanoil has operated in this plant for periods as long as 7200 hours with no appreciable change in viscosity or acidity, and it has not been necessary to change oil in some units in over a year.

If you are obliged to change hydraulic oil frequently or have deposit trouble, erratic operation, or persistent foaming, let a Standard Lubrication Engineer analyze your problem. A change in the hydraulic system or a change to Stanoil, or both, may save labor, down time, and oil.

What are YOUR problems in maintenance and lubrication?

The few examples cited here are typical of jobs Standard Lubrication Engineers are doing daily for operators who have asked for help. Take the time to explain your problems to one of these Engineers. He may have a number of suggestions that will help you save much needed manpower, material, and scarce equipment. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 5, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

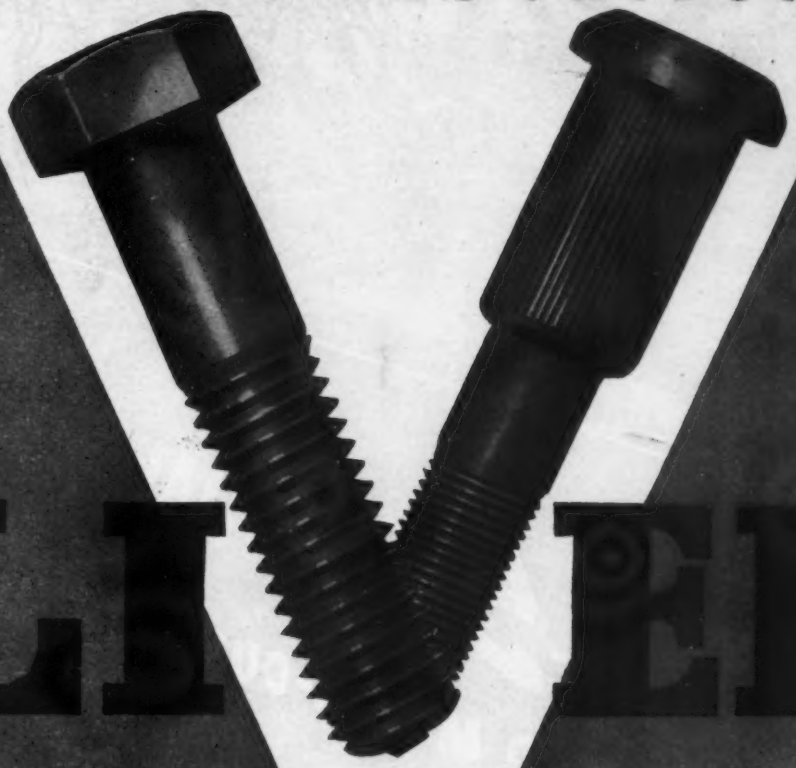
Can't throw Stanodrip. Lubrication of stitching machines making wire bound boxes is a tough job. Action of many parts on the machine is very rapid and jerky. Ordinary lubricants tend to fly off in all directions. Oil on the box wood spoils the work. Oil on operators means less oil stays in the machines.

Machine operators were the first to cheer for Stanodrip when it was tested. They got less spoilage, less trouble from machines because of too little lubricant, and spent less time putting oil on the machine and taking it off of themselves. Stanodrip is on this job to stick.

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

COOPERATING IN WAR PRODUCTION



OLIVER FASTENERS

ACCURATE . . . DEPENDABLE . . . ALL SIZES

It was in the Civil War that Oliver fasteners were first called into Uncle Sam's war service. Today, standard and special Oliver bolts, nuts, rivets, studs, cap screws are widely used in the construction of hundreds of types of war equipment—tanks, trucks, gun mounts, tractors, aircraft engines, etc. as well as in ships, railroad track and rolling stock, and a host of other items vital to the war effort.

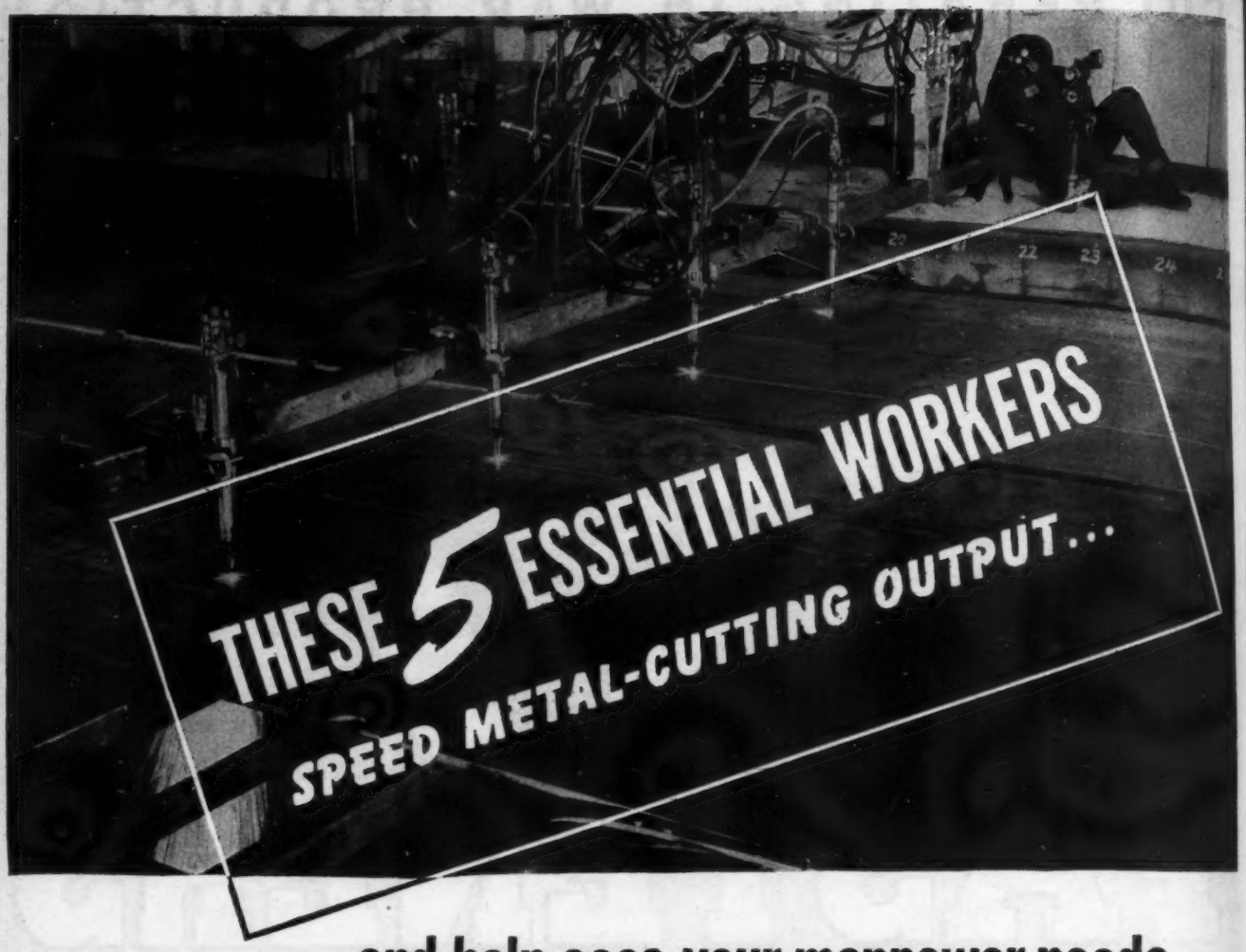
Because Oliver bolts, nuts and rivets fit accurately, hold tight, are full strength and long-lasting, they are the first choice of experienced users everywhere.

The Oliver line is *complete*, with thousands of types and sizes of standard fasteners, as well as scores of special designs. Materials include carbon steels, alloys and non-ferrous materials. Heat-treatments are used for high strength, hardness. Finishes and coatings include black and bright finishes, galvanizing, zinc plating, etc. as required.

OLIVER
IRON AND STEEL
Corporation

ALL FOR VICTORY
OLIVER

SOUTH TENTH AND MURIEL STREETS . . . PITTSBURGH, PENNSYLVANIA



... and help ease your manpower needs

One man or woman operator, and four or more cutting torches on an Airco Travograph—that's an ideal way to meet your steel-cutting needs, and also partially simplify your manpower problem.

Many metal-fabricators are using this productive, multiple torch Airco gas cutting machine to shape large-area steel plates quickly and accurately — and help eliminate many manpower bottlenecks. Once the torches are lighted and cutting begins, Travograph operation is virtually automatic.

The Travograph is motor-driven and moves on a track alongside the work. Movement of the cutting torches is controlled by a tracing device which follows a template of the part to be cut. Using multiple torches, regular shapes or intricate contours may be flame-cut in quantity out of the largest plates.

Both for today's need for speed and for post-war cost-savings, the Travograph offers valuable advantages. For complete details on this Airco gas cutting machine, call or write any Air Reduction office.

★ BUY UNITED STATES WAR BONDS ★

AIRCO WILSON

AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

In Texas: MAGNOLIA AIRCO GAS PRODUCTS CO. • General Offices: HOUSTON 1, TEXAS

Offices in all Principal Cities

SQUEEZ-GRIP...

—Makes Every Worker a 'Speed-Ball' Fireman

If a fire in your plant is to be extinguished in seconds, with carbon dioxide, then not a second ought to be wasted in releasing this swift fire-killing gas against the fire. With the new SQUEEZ-GRIP valve you can carry a C-O-TWO portable to a blaze and *without* setting the extinguisher down, release carbon dioxide as fast as you can close your hand. No hand wheel to turn to open or close the valve; just squeeze the release lever over the carrying handle, and away goes the sub-zero gas to blanket the fire in its tracks—without damage to materials or machinery. SQUEEZ-GRIP saves time and gas. *It's Safer—It's Faster.*

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1, NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

DOUSED DAILY!

G-E Tri-Clad motor coupled to a centrifugal pump on a portable cleaner in the milk plant of H. P. Hood & Sons, Inc., Charlestown, Mass.

POWERING A DAIRY PUMP, this Tri-Clad splashproof motor gets a dousing every day as the plant is hosed down. After years of service, frame and end shields are virtually uncorroded, insulation is going strong. G-E "protection tests", both in the development of the Tri-Clad design and in our daily production, help us assure you of long-lasting service from Tri-Clads on motor-wracking jobs like this.

"Hot Box" at 100% humidity tests TRI/CLAD motor protection

REG. U.S. PAT. OFF.

Here is one of the many development tests which helped to prove the *extra* stamina engineered into the Tri-Clad design. In the bottom of this moisture box, just below the motor base, two inches of water was maintained at 212 F. The cover kept the humidity within the box at 100 per cent. By operating motors in this atmosphere to the breakdown point, G. E. got the low-down on the coil insulation's moisture resistance. Tri-Clad motors, in both open and splashproof construction, showed up unusually well in this extra-severe test. *General Electric Company, Schenectady, N. Y.*

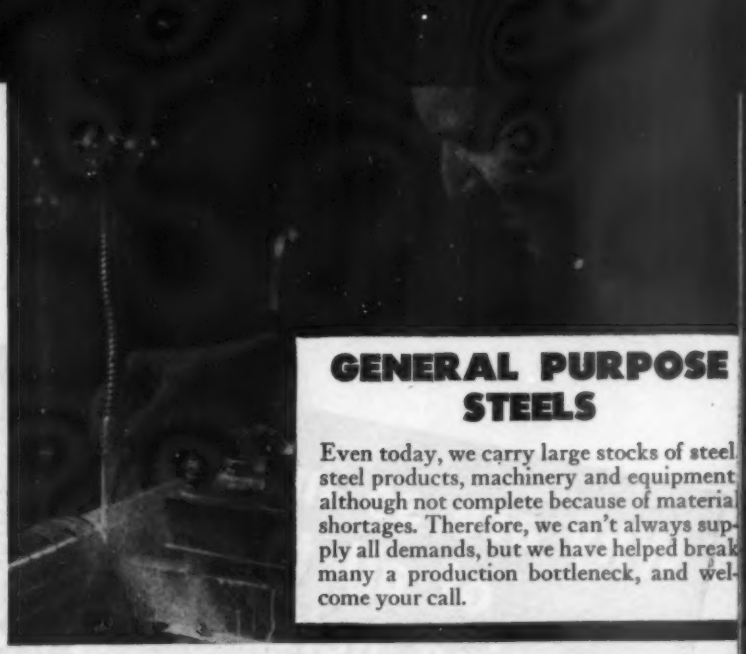
GENERAL ELECTRIC

TRI/CLAD MOTORS

Every week more than 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

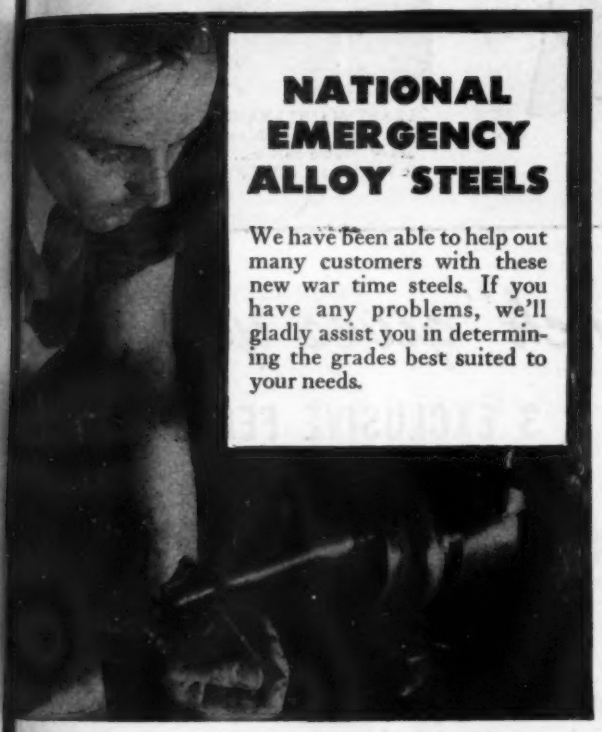
LOOKING FOR STEEL?

ll to us may solve your problem. Our job is to keep war duction moving, so if you need steel, we'll get it to you hurry, if at all possible—subject, of course, to priority lations. We will appreciate receiving your inquiries—ne, write or wire our nearest warehouse. You'll get mpt, courteous attention.



GENERAL PURPOSE STEELS

Even today, we carry large stocks of steel steel products, machinery and equipment although not complete because of materia shortages. Therefore, we can't always supply all demands, but we have helped break many a production bottleneck, and welcome your call.



NATIONAL EMERGENCY ALLOY STEELS

We have been able to help out many customers with these new war time steels. If you have any problems, we'll gladly assist you in determining the grades best suited to your needs.

AIRCRAFT STEELS

These steels are for use in airplanes and available at our Chicago Warehouse only—which has been designated by the WPB as a warehouse to distribute them:

WD-X-4130 SHEETS
Open Hearth, Pickled and Oiled to Spec. AN-QQ-S-685. All gauges .016 to .50, sheets 18 x 72".

NE-8630 SHEETS
Open Hearth, Pickled and Oiled to Spec. AN-S-12. All gauges .016 to .50, sheets 18 x 72".

STAINLESS STEEL BARS
Spec. AN-QQ-S-771.

STAINLESS SHEETS
Spec. AN-QQ-S-772.
Spec. AN-QQ-S-757.

Write, phone or wire, if you are eligible for these steels.

WELDING ELECTRODES—ALL TYPES

Send for our new Stock List and Reference Book—it's FREE

Send for FREE copy of our new Stock List and Reference Book

UNITED STATES STEEL SUPPLY COMPANY

CHICAGO (90),	1319 Wabansia Ave., P. O. Box MM	Teletype CG. 605	BRUnswick 2000
BALTIMORE (3),	Bush & Wicomico Sts., P. O. Box 2036	Teletype BA. 183	GILmore 3100
BOSTON (34),	176 Lincoln St., Allston, P. O. Box 42	Teletype BRTN. 10	STAdium 9400
CLEVELAND (14),	1394 E. 39th St.,	Teletype CV. 153	HEnderson 5750
MILWAUKEE (1),	4027 West Scott St., P. O. Box 2045	Teletype MI. 587	Mitchell 7500
NEWARK (1), N.J.,	Foot of Bessemer St., P. O. Box 479	Teletype NK. 74	Bigelow 3-5920
		REctor 2-6560 -	BErgen 3-1614
PITTSBURGH (12),	1281 Reedsdale St., N. S.	Teletype PG. 475	CEdar 7780
ST. LOUIS (3),	21st & Gratiot Sts.,	Teletype SL. 384	MAin 5235
TWIN CITY,	2545 University Ave., St. Paul (4), Minn.	Teletype STP. 154	NEstor 2821

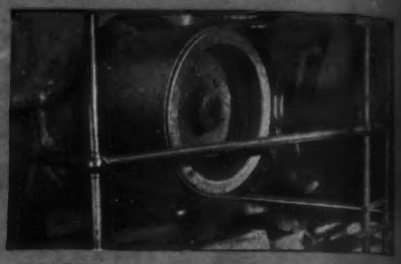
UNITED STATES STEEL SUPPLY COMPANY
USS STEELS
SERVICE

UNITED STATES STEEL

You'll Profit ~~more~~ MOST

Why are so many drives of all types being belted with . . . "Research"?

GRATON AND KNIGHT



LEAST MAINTENANCE: This suction pump in a paper mill is driven by a "Research" 18" heavy double belt that has required no takeup in 7½ years. 125 HP motor, 585 RPM.

. . . Because "Research" gives you

THE 3 BIG ADVANTAGES OF QUALITY + LEATHER

MORE PRODUCTION, because leather's superior traction, which improves with age, means more power delivered . . . greater average machine production.

LESS MAINTENANCE, because leather has natural "give-and-take" to handle shock loads without undue strain on belt or equipment.

LONGER LIFE, because the tough, interlocking fibres of leather have high resistance to both surface wear and internal friction.

and

3 EXCLUSIVE FEATURES OF "RESEARCH" + BELTING

MOST PRODUCTION, because "Research" currying, added to leather's superior traction, creates highest frictional surface. 3% more production guaranteed.

LEAST MAINTENANCE, because G&K's prestretching process removes non-elastic stretch, resulting in fewer take-ups. Tensile strength is also increased 15%.

LONGEST LIFE, because precise, weight-controlled lubrication of fibres develops extremely long life. "Tension-Cementing" insures against ply separation.

YOU'LL GET AT LEAST 3% MORE PRODUCTION
. . . 2 to 4 TIMES LONGER LIFE . . . ON LONG OR SHORT CENTERS

With Research Belting's "DOUBLE + + PLUS"

MODERN DRIVE. Experience of Missouri chemical plant with "Research" 8" double, driving compressor from 40 HP motor on pivoted base — no take-ups or adjustments since installation, 12-hour daily operation.

LONG LIFE: Installed in 1917 to drive a generator from three water wheels, this 22" 3-ply "Research" belt has given efficient service ever since, despite immersion three times in floods.

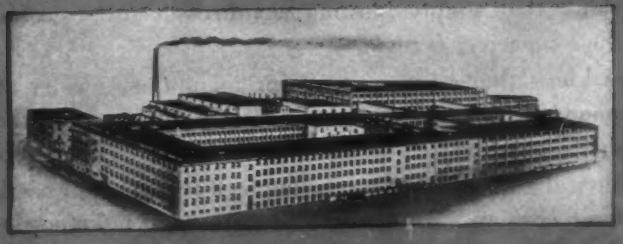
ANOTHER MODERN DRIVE: Replacing idler drive in cotton mill, "Research", driving a compressor (60" x 16" pulley) from 60 HP motor (16" x 16" pulley) on 72" centers, has given trouble-free operation since 1940.

In G&K's currying process, the amount of grease worked back into the dry leather to give pliability and frictional surface is controlled by precise weighing — for more "built-in" pulley grip.

An exclusive method — pre-stretching according to hide characteristics — removes initial stretch and increases tensile strength — proved by "Research" performance in eliminating excessive take-ups.

Tension-Cementing — replacing hand methods — applies the cement with perfect uniformity while belt is under working tension — for most uniformly high adhesive strength ever obtained in belting.

Research Belting is manufactured from green hide to finished product under one roof, under one control—in the world's largest industrial leather plant



GRATON & KNIGHT COMPANY

WORCESTER 4, GRATON AND KNIGHT MASS.

Graton & Knight is the only leather belting manufacturer with complete nation-wide service facilities. Branches in Chicago, Cleveland, Dallas, Detroit, Kansas City, Minneapolis, New York, Philadelphia, St. Louis, San Francisco; distributors in all industrial centers.

Look under "Graton & Knight" in Belting section of Classified Telephone Directory or THOMAS' REGISTER.

Let in Industrial Leathers Graton & Knight, in addition to a complete line of leather belting, manufacture "Spartan" Leather Packings, the "Orange Line" of Hairitan Loom Leathers, other textile leathers, and a wide variety of specialties used in many industries. When you consider the possibilities of adapting the many natural advantages of leather to any industrial purpose, be sure to get the advice of Graton & Knight, responsible for the successful use of more industrial leather products than any other firm in the world.

MORE PULLEYS ARE BELTED BY "RESEARCH" THAN BY ANY OTHER BRAND!

Why HOBBLE an ELECTRICAL GIANT?

★ The output and efficiency of many an electrical machine depend pretty much on how fast it can get rid of the heat it creates.

You might think that simply blowing air through such machines could increase their capacity. *It could.*

But engineers know that when you set air in motion, you greatly multiply the amount of dust and other impurities it carries. Since these deposits are usually good heat insulators, the problem is not simple.

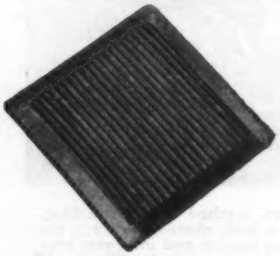
Must our electrical giants, therefore, be hobbled by unsolved cooling problems? *Must* we continue to build them bigger—and more costly—than necessary?

Fortunately, developments in air filtration now invite designers to take advantage of mechanical ventilation without the penalty of dirt. Air-Maze now offers filters especially designed for ventilated housings. Light, compact, efficient and permanent, they promise that much electrical equipment soon will be smaller, lighter, cheaper—and easier to maintain.

★

Why not Supercharge Transformers ...for one thing?

Built-in mechanical ventilation would permit air-cooled transformers to handle greater loads within safe temperature limits. Proper filtration would keep them clean. It's food for thought.



AIR-MAZE CABINET FILTER
One of over 3,000 types

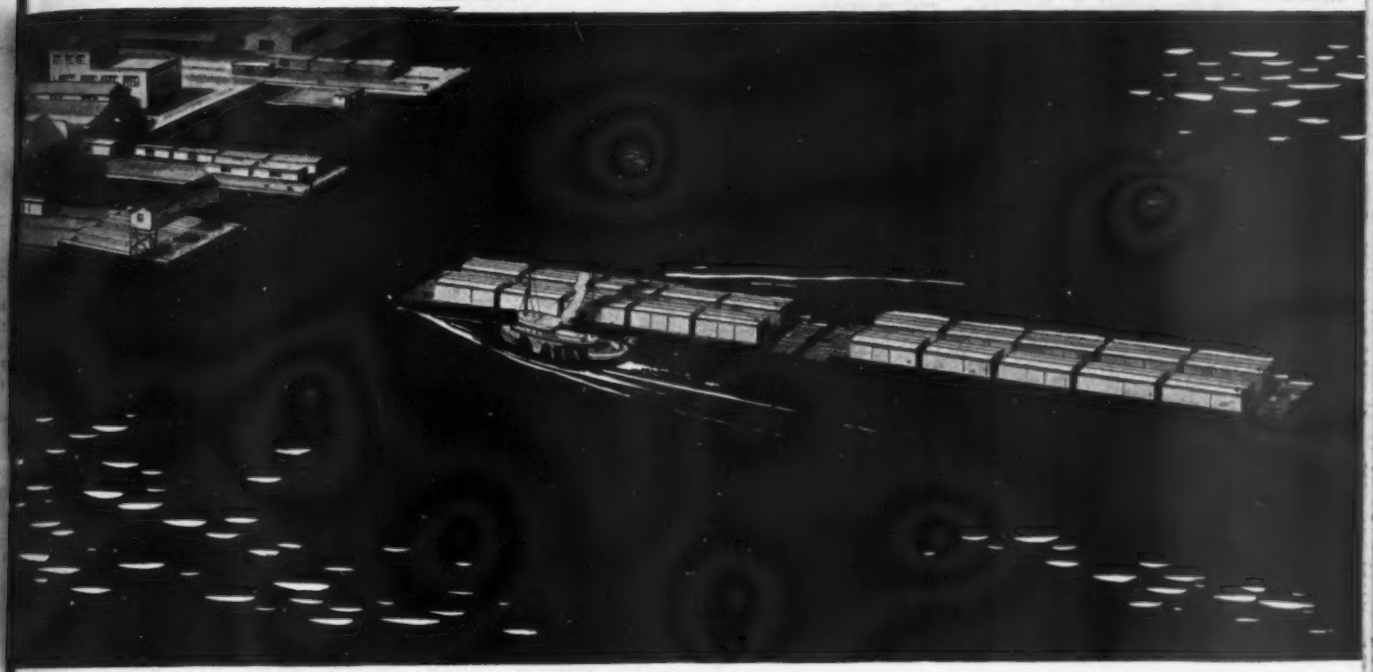
AIR-MAZE CORPORATION • *Engineers and Manufacturers* • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • *In Canada:* Williams & Wilson, Ltd., Montreal, Toronto, Quebec, Windsor

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

stop LOADING AND UNLOADING



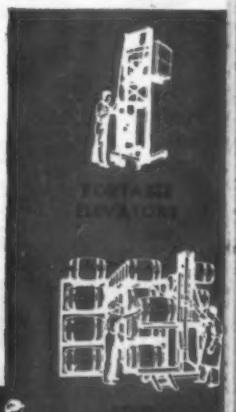
RAILROADS that *ferry* loaded cars across big gaps of water have the right idea. Instead of *un*loading and *re*loading, they move an entire trainload.

That's the same simple, practical idea that makes Barrett Lift-trucks indispensable in all kinds of industrial plants. By handling materials as a complete unit, *on skids,* they eliminate unnecessary loading and unloading of separate pieces or containers —enable one man to do the work of three or four.

This is the kind of materials handling that saves time, manpower and cuts costs. It can be used profitably in your plant. A Barrett Engineer will gladly show you how.

The Barrett Junior Catalog is yours for the asking.

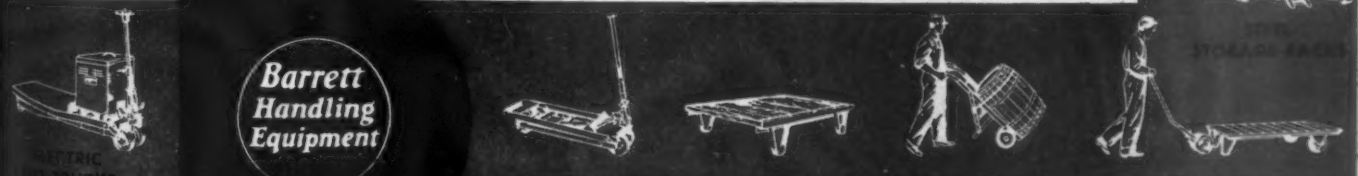
BARRETT-CRAVENS COMPANY
3261 West 30th Street • Chicago, Illinois
Representatives in All Principal Cities

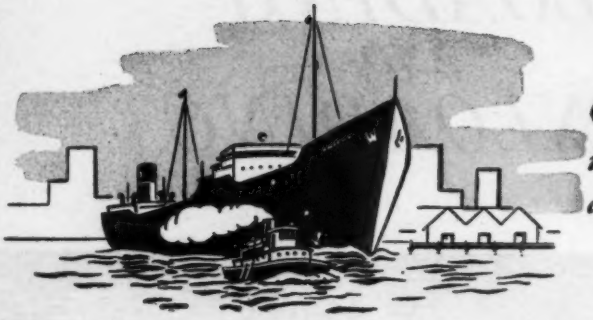


BARRETT

ONE MAN DOES MORE THAN 3 OR 4 . . . WITH A BARRETT LIFT-TRUCK

Barrett Handling Equipment





On Thanksgiving Day, a Westinghouse Supervisor in New York was just sitting down to his turkey dinner when a long distance call came through.

He ran out on the Turkey

BUT THE TANKER SAILED!

A tanker in Mobile, Alabama, about to sail for the war front, needed immediate replacement of two Micarta stern tube bearings.

The New York supervisor phoned three workmen to meet him immediately at the Westinghouse District *Manufacturing and Repair** Plant.

Micarta sheets were taken from the storeroom, saws and milling machines set up—and the bearings made, packed and shipped by 10:30 that night.

Forty-eight hours from the time the order was entered, the bearings arrived in Mobile. And the tanker sailed on time, to help supply an important military operation.

Westinghouse M & R men have the "know-how" that comes only from years of experience. Each plant is backed by the complete engineering, research and manufacturing facilities of the Westinghouse Company.

J-90502

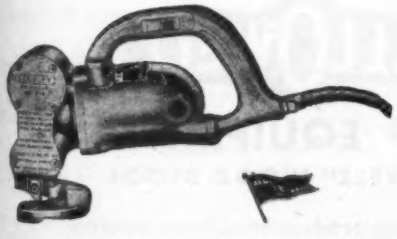
When vital electrical equipment needs repair... phone the nearest office of Westinghouse Electric and Manufacturing Company for

Westinghouse

COMPLETE REPAIR SERVICE

***33 M & R PLANTS • • ONE NEAR YOU**

UNISHEARS Cut Sheet Metal *Faster!*



Stanley Unishear No. 214 — Cutting capacity 14 gauge hot rolled steel.

Stanley Unishears cut sheet materials as fast as you feed, up to 15 feet per minute — follow any line accurately, straight, curved or angle — leaving smooth, clean edges with no waste of material. Plenty rugged for tough production or maintenance use.

Portable Unishears are made in four models — for 18 gauge, 16 gauge, 14 gauge and 12 gauge hot rolled steel or galvanized iron. Stationary Unishears are also available to cut 14 gauge and 10 gauge sheets. Write for literature. Stanley Electric Tool Division, The Stanley Works, New Britain, Connecticut.

STANLEY

TRADE MARK

STANLEY UNISHEARS

Electrically Driven Metal Shears

STABILITY
For Handling Precision Work

Here "Hallowell" Work-Benches of Steel have been used because their stability and uniformity make them ideally suited for the job. The bench legs are flanged and ribbed and to make their stance firmer still flanged stringers tie each set of legs together into an extremely rigid structural unit.

"Hallowell" Work-Benches are perfectly adapted, for assembly, testing, packing, wrapping and manifold other functions and they come in a wide variety of ready-made combinations. Moreover, they can be joined end to end, used singly, or formed into handy functional units. They are available with drawers, shelves, or whatever other special equipment is needed . . . Why not send for the "Hallowell" Catalog to help you plan, then let us know your needs?

Duration Type
"HALLOWELL" WORK-BENCH OF WOOD

for use where steel work-benches are prohibited by wartime restrictions. Large selection available. Write for Bulletin *577*.

Fig. 1968
Drawer is extra

Fig. 1927
Pat's Pend.

HALLOWELL

SHOP EQUIPMENT
"HALLOWELL" WOOD STOOL

Another wartime product. Sturdily constructed, of selected hardwood. Various sizes, with or without backs. Send for Bulletin *575*.

OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 545 · BRANCHES: BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO

There are many GOOD THINGS AHEAD . . .

Soybeans will certainly be one of the country's important crops in the future. A single acre of land devoted to them will produce about seven times as much protein as it would if planted to corn for the feeding of hogs.

The war has checked the spread of quick-freezing locker plants which were spreading across the country from the farming states at the rate of about fifty new plants each month. A million patrons are already withdrawing two million pounds of food from their lockers daily. Home-sized quick-freezing units will probably be combined with mechanical refrigerators in after-the-war models.

The fluorescent tube may have many uses besides those already familiar. Inks that show under ultra-violet light are already in use to mark laundry, and are being tried out in hospitals for the identification of babies. Fluorescent materials help in the detection of theft and sabotage, and in the detection of altered documents. Fluorescent lighting distinguishes between butter and margarine, determines the freshness of eggs and nuts, or the adulteration of coffee, lard and olive oil. Experts can even tell, with its help, from what flowers a sample of honey has been made.

Powdered glass is being pressed into shapes and fused by heat in a manner similar to the technique used for powdered metals.

A machine is reported in which a photo-electric cell scans a drawing and operates a machine that produces the part shown in the drawing.

Cotton, laminated with thermo-setting plastics, is being tried as a substitute for sole leather . . . semi-flexible, water repellent, and similar in appearance to leather, but longer wearing.

New "rare-element" glass that contains no sand makes optical glass for camera lenses with twice the speed of any former lens.

A new method of cutting metal uses slightly worn band-saw blades run at approximately ten thousand feet per minute. The high speed of the saw actually melts the metal in its path.

Baking dishes can now be made of special paper that resists heat to 350 degrees.

The photo-electric cell (or electric eye) was first introduced to the public as an automatic door-opener. Now it sorts fruit, smoke and fire, levels elevators, records automobile speeds, counts pills, matches colors, sorts merchandise, turns on lights, measures machined parts, detects flaws in metal and is the heart of television. Its use has only begun.

Backyard gardeners will be pleased to know that experiments are being made with high-frequency currents to kill insect pests in the ground.

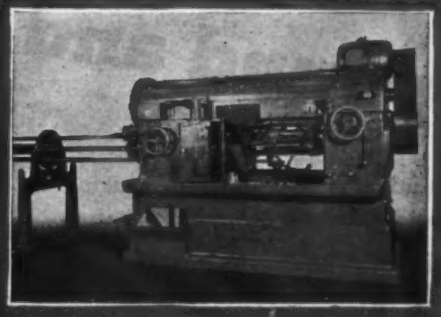
An immediate post-war demand is expected for two million one-hundred thousand automobiles, one-million five-hundred thousand mechanical refrigerators, one-million two-hundred thousand washing machines, one-million two-hundred thousand radios, nine-hundred thousand electric irons, and six-hundred thousand electric sewing machines.

The Basic Magnesium, Incorporated, plant near Boulder Dam, largest single electrical installation in the country, uses eighteen million dollars worth of silver in place of copper to carry its current.

A patent has been issued for a method of transcribing eight hours of continuous reading by variably magnetizing a spool of fine wire the size of an ordinary spool of cotton. With this wire in a radio-like machine, a housewife could attend to her domestic chores and listen to the reading of an entire book at the same time.

A new camera takes three million pictures in a single second.

If you are looking ahead
you will be interested in production like this



This 4½ bronze valve stem is produced on the 6-spindle Conomatic in nine seconds — nine seconds for eleven operations including four forming cuts, four cuts with roller turners, two threading operations and cutting off — all to close tolerances.

This is real production — the sort of production that is winning the war — the sort of production that you will need in your plant to meet competition when the war is over.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

Scrap a pound and save 4 more

EACH pound of scrap used in making war steel replaces a pound of pig iron.

To make one pound of iron requires nearly four pounds of ore, coal and limestone.

So when you turn in a pound of scrap you also conserve four pounds of vital raw materials. Translate this saving into terms of the 6,000,000 tons of steel scrap that the industry needs today. It is the equivalent of:

12,000,000 tons, or 240,000 carloads of iron ore,

7,200,000 tons, or 144,000 carloads of coal,

3,000,000 tons, or 60,000 carloads of limestone.

Think also of saving the millions of man hours of labor involved in mining, transporting and processing these 444,000 carloads of raw materials — enough to form a solid train stretching from Boston to San Francisco.

The more dormant scrap YOU salvage, the greater the amount of America's materials, machines and manpower is released for the all-important task of winning the war now.

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

THROW YOUR SCRAP INTO THE FIGHT — YOUNGSTOWN

THIS ADVERTISEMENT SPONSORED BY

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Youngstown, Ohio

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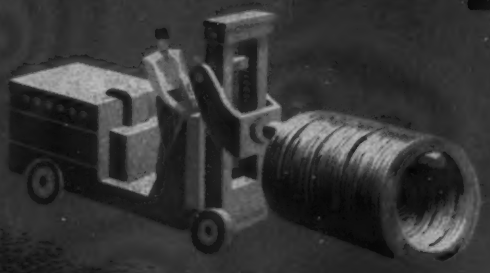
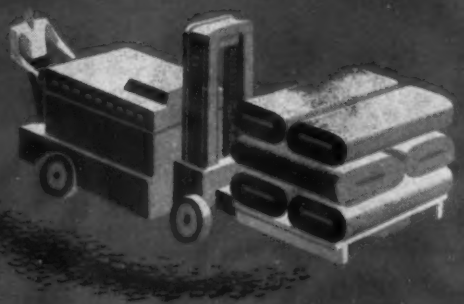
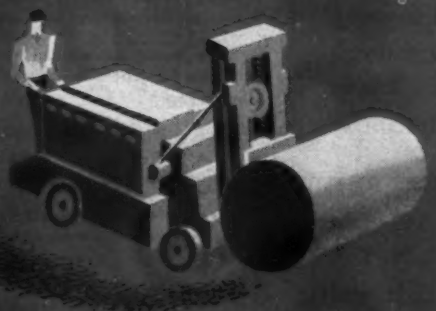
Get 10% more work out of your electric trucks with

PHILCO *Storage Batteries*







With Philco "XL" Batteries in your electric industrial trucks, every charge hauls 10% more material! Every cell provides 10% extra capacity without increase in overall battery dimensions!

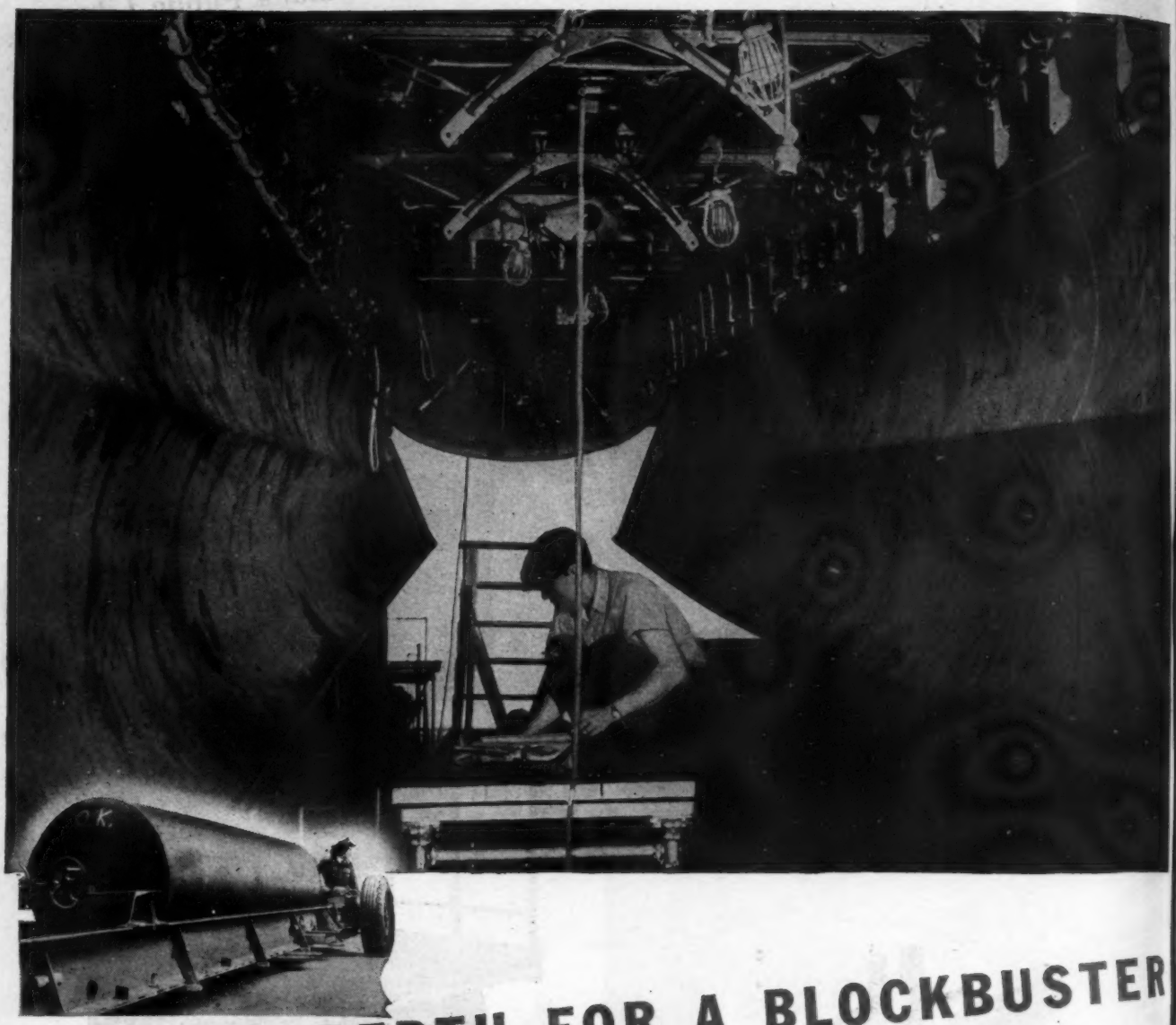
The *extra work* you get from a Philco-powered truck is the reason materials handling men in war plants, embarkation ports and warehouses from coast to coast are replacing worn out batteries with rugged, heavy-duty Philco cells.

For the name of your local Philco representative, consult your classified telephone directory. Write for the Philco Industrial Truck Battery catalog.

Philco Corporation, Storage Battery Division, Trenton 7, N. J.

REPLACE WITH RUGGED PHILCO BATTERIES

ARMY E ★★ NAVY



BERTH FOR A BLOCKBUSTER

WHEN you're upstairs carrying an 8000 lb. super-blockbuster, it's mighty comforting to know that everything will work according to schedule. Blockbusters must fall on the target.

In wrestling with the 1001 problems incident to the mass production of war munitions, management is finding definite help in Texaco Engineering Service and Texaco Petroleum Products.

So effective have Texaco lubricants proved that they are definitely preferred in many fields, a few of which are listed on the right.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States.

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

TEXACO

TEXACO Lubricants, Fuels and Engineering Service

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Free Enterprise

. . . INCENTIVES AND TAXATION

There are three principal ways of making a living:

1. Getting on someone's payroll
2. Lending one's savings to business enterprises
3. Starting, or helping to start, a business enterprise

About three out of four of us fall in the first group—we are *job-holders.* Millions of us get some income, large or small, by lending our savings—directly or through such channels as insurance companies. We are suppliers of *loan-capital.* About one out of four of us has his own business enterprise, and several millions of us are part owners of business enterprises. Those of us who go into business for ourselves and those of us who are part owners of enterprises are *job-givers.*

The amount of employment in a community depends, in the main, on the number of persons who attempt to make their living, or part of their living, by giving jobs to others, rather than by getting on someone's payroll. A community seriously desiring a high level of employment and a high standard of living will strive to make job-giving attractive and to encourage a large part of its population to be job-givers rather than merely job-holders.

The number of men who attempt to make their living in whole or in part by starting new businesses or by expanding old ones depends upon the outlook for profits. When the outlook for profits improves, thousands of new jobs open up and thousands of men go to work; and, as men go to work, the farmer and everybody else benefits. When the prospect for profits becomes darker, the demand for labor, capital, and raw materials drops. It may be roughly estimated that an improvement in the prospect for profits of one billion dollars raises the demand for labor by anywhere from two billion dollars to five billion dollars.

One of the principal determinants of the outlook for profits is the amount and the nature of taxes. After the war, the Federal government will need to raise each year about twenty billion dollars in taxes—three times the amount required before the war, and six times the amount re-

quired in the Twenties. In the Twenties, the tax needs of the Federal government were roughly twice as large as corporate profits in a good year. After the war, Federal revenue needs will be roughly three times corporate profits in a good year. Obviously, it will be much more difficult, after the war, for the government to meet its needs ***without discouraging enterprise,*** and therefore without diminishing the number of jobs, than it was before the war. Far more than ever before, it will be necessary for the government in developing a tax program to take account of the effect of taxes upon employment and the standard of living. This means that it will be important for each and every citizen to give attention to these matters—because the policies of the government reflect, in the main, the thinking of the citizens.

Some taxes seriously discourage individuals and business firms from undertaking new and enlarged operations. Other taxes have little or no adverse effect on investments. Some taxes are a burden on consumption, affecting the sales of specific commodities, depending on the nature of the taxes. It is obvious that different kinds of taxes have different economic influences. ***We must understand the forces that determine the level of employment and consider the tax program in relation to other measures designed to create more jobs.***

What are the tests of a good tax system?

1. **Taxes should be designed to encourage production and enterprise and to make it attractive for a large number of people to earn all or part of their living by giving jobs to others.**

2. **Taxation must be fair in principle and administration, with no discrimination between persons in similar circumstances.**

3. **Taxes should be apparent and not concealed, and should be levied, in the main, directly upon individuals so that each of us will know how much our government is costing him. A moderate income tax at the lower income levels will bring a greater awareness of responsibility than will heavy taxes on consumption which the taxpayer does not see because they are hidden in the prices he pays.**

4. **In the aggregate, taxes should be somewhat progressive.**

5. **The tax system should be coordinated with the broader objectives of monetary and fiscal policy.**

6. **Federal, state, and local tax policies should be integrated as to principles and objectives.**

Judged by these standards, our present tax system is extremely unsatisfactory; in fact, it is actually damaging. It is a conglomeration of hidden and direct taxes and of conflicting taxing jurisdictions and policies, with no comprehensive economic motive. It is distorted to appease pressure groups and includes uneconomic punitive measures. It is full of needless complexities. It is a paradise for tax lawyers and a source of confusion and despair for the honest, enterprising business man. In fact, it would seem almost as if our tax laws had been written by some fifth columnist for the purpose of making private enterprise unworkable. We in America pretend to believe in the pioneer spirit, but no one would ever suspect it by looking at our tax system.

When the war is over, there must be a thorough reform of our entire tax system. Federal taxes can and should be reduced substantially; and, in the process of reduction, changes can more readily be introduced. At that time, steps can be taken to achieve some degree of coordination and unity of purpose among federal, state, and local taxing agencies. Taxes play too important a role in our total economic life to ignore the adverse consequences of unrelated and inconsistent policies of different taxing jurisdictions.

The following reform measures are needed in federal taxation:

1. **Repeal of the excess profits tax at the earliest possible date after inflationary dangers subside. In the case of most enterprises, the excess profits tax destroys all incentive to do a larger volume of business than in 1939; it appropriates virtually all increase in profits above the level of 1939.**

2. **Coordinate corporation and individual income taxes so as to avoid double taxation and impediments to risk-taking. Preferably, corporation income taxes should be wholly eliminated. Otherwise, the corporation tax rates should be reduced to the lowest effective rate on personal incomes. Full credit should be given to stockholders for all corporate income taxes paid.**

3. **Encourage competition and particularly the formation of new enterprises by allowing new corporations generous tax exemptions for a period of five years. Extend the same principle to unincorporated concerns.**

4. **Encourage risk-taking (and hence job-**

giving) through extending the loss carry-over to six years or more.

5. Provide for averaging incomes over a period of years in order to remove discrimination against those with irregular incomes and those who take risks of loss in business ventures.

6. Rely upon the personal income tax as the main source of revenue, with broad coverage. The reduction in total taxes after the war should favor the elimination of excise taxes before reducing income taxes.

7. Reduce the upper range of personal income tax rates to a maximum of perhaps fifty to sixty per cent so that risk-taking investments will be really attractive. Higher rates are punitive in character, yield small receipts, and throttle risk-taking.

8. Encourage risk-taking by individuals in the higher brackets by making the surtax on incomes of $20,000 a year or more half as much on income in the form of dividends as on income in the form of salaries or interest.

9. Encourage risk-taking by individuals by permitting capital losses to be charged against general income provided the reduction of tax liability in any one year is not more than fifty per cent.

10. Repeal the tax-exempt privilege for all *new* securities issued by all governmental jurisdictions.

11. Eliminate excise taxes which place a disproportionate burden on persons with lower incomes so as to encourage greater consumption and provide an expanded market for our vast industrial capacity.

12. Reform tax administration to simplify forms and procedures, to broaden the scope of enforcement, and to encourage the spirit of fairness.

With such reforms and continuing reappraisal of the tax program as it affects the economic situation, we can look toward taxation as an instrument of constructive influence in giving the fullest encouragement to free enterprise and in attaining continued prosperity.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

Industry Faces Uncertainties

With more people employed than ever before, and with production at an all-time peak, industry nevertheless faces problems of production shortages and manpower scarcities. The production shortages will be in civilian goods and a few items of war materiel, and the manpower scarcities will be in the No. 1 manpower areas.

Except for a few items, there is no scarcity of materials. There have been some cut-backs in war orders, and some manpower has thereby been released. Why, then, can't the released manpower be put to work turning the available materials into civilian products? There are two principal reasons:

1. Cut-backs are made, as much as possible, in No. 1 manpower areas, so that the manpower released will be available for use on the items where manpower is short (airplane engines, airframes, trucks, bearings, communications equipment).

If reverses on the fighting fronts should cause a national nervousness, and some considerable part of the responsibility should be laid at the door of either management or labor because of shortages in critical products, the public might demand drastic action that would leave its mark for a long time. For one thing, a national service law, with all its possibilities for the introduction of government control into industry, would be enacted posthaste.

Until such time as the critical products are being turned out in quantities sufficient to satisfy the services, there will be no extensive allocation to civilian production of materials and the manpower necessary to work them up. There still are things that industry, labor, and government in cooperation can do to bring about conditions that will induce manpower to go into the No. 1 areas and the critical plants and make good the existing shortages.

2. The materials and manpower that seem to be available may be needed very suddenly for the services.

Even if there were no specific shortages in war materiel it is doubtful if many plants would be permitted to reconvert or engage in the manufacture of civilian goods at this time. If one goes to the right places and talks to the right people in Washington, he learns very quickly that the policy of today is to permit no materials to be cut up, no manpower to become unavailable to war plants, no plant capacity to be taken away from the war effort until the invasion on the European western front actually has been made, beachheads have been established, and major counterattacks have been repulsed.

Undoubtedly hindsight will show that some materials and some manpower could have been made available during this period. Undoubtedly there will be harsh criticism at some time in the future of this policy of restraint. But the coming invasion is an undertaking so vast, and so full of uncertainties, that only wholehearted agreement can be given at this time with the policy here described. As Donald Nelson has put it, "I would rather be two months late in reconversion than five minutes late in military production."

Actually, the outlook for reconversion—for partial return to the production of civilian goods—does not seem as bright as it did a month ago. A month hence the picture may have changed again. A new and weighty factor—the invasion—has entered. Obviously, the uncertainties of such an undertaking, in a war of equipment, must find their reflection in industry, the source of that equipment.

L C Morrow

Rehabilitation of Veterans Must Begin Now

CHARLES B. COATES, Associate Editor, *Factory*

WHEN Pfc. Joe Jones comes home, wearing a Purple Heart and a crutch, can industry give him a job?

By every present appearance, industry can—and will. And it seems fairly safe to say that the plant with a modern medical department and a comprehensive program of employee relations will take Joe's case in stride.

Here, distilled from FACTORY case reports on management experience, is roughly the way in which Joe's "rehabilitation," a loathsome word to Joe, will ideally be handled:

1. Joe is interviewed at the employment office in a seemingly routine way—but his card is flagged "veteran—disabled" and is thereafter marked for extra-considerate attention.

2. He then goes to the medical department where two things are ascertained as fully as possible—the exact nature of his disability and the exact scope of his physical capability. For example, he can walk but can't carry, or he can work standing but can't crouch or stoop.

3. These data then go to a plant placement specialist, counselor, or job analyst. At his hand are detailed descriptions of the kinds of physical activity required by every job in the plant, with notes on the working conditions in each department.

4. The specialist matches up Joe's medical report with the job descriptions until he finds something Joe can do or be trained to do. Then he takes him around to the foreman, and Joe is hired. If he requires special training, he gets it.

5. Joe thereupon takes his place in the plant—not as a physical freak, or a self-conscious "hero," or an object of pity, but simply as Joe Jones, a self-sustaining American citizen who is ready to vote, raise a family, pay taxes, and give an honest day's work for an honest day's pay. This suits Joe fine.

6. It doesn't end there. The medical department and the placement specialist keep an eye on Joe and maintain close touch with his foreman. Possibly they discover that they guessed wrong on Joe's first job. Possibly the noise in his department—or the dust, or the distance from the plant cafeteria, or any one of a thousand things including, for that matter, the foreman himself—may be getting Joe down. Result: Reanalysis, reassignment, retraining (if need be), and transfer to a job where Joe can work with confidence.

7. Nor does it end there. Implicit in the company's whole attitude toward Joe, in all his contacts with the personnel department, the medical department, and his supervisors, there is a sort of continuous unspoken assurance that his employers "give a damn" about him.

For one thing, Joe has some difficult adjustments to make. He has come blinking into the sunlight of civilian life, back to personal freedoms and responsibilities he had almost forgotten, and the light may seem a little strong at first. He feels somewhat "out of it" and needs reassurance.

For another thing, Joe's disability may not even be symbolized by anything so obvious as a crutch. He may be one of the war's "psychological casualties" either to the severe degree of "combat fatigue" or "psychoneurosis," or to the lesser degree that is commonly called "nervousness." In that case, he won't be given work in noisy departments or under a temperamental foreman. He will also be made to feel that he has friends in the management, in whom he can confide. There may even be a psychiatrist (so trained but not so labeled) on the company's medical staff.

Now those, to repeat, are the *ideal* steps, in outline, by which Joe's so-

What's in This Article

Definition of Problem ¶ Size of Job ¶ Top Management's Responsibility ¶ Part Played by Veterans Administration ¶ Treatment of Psychological Casualties ¶ Case material from Ford • Eastern Aircraft • Arma Corporation • Caterpillar Tractor • Cleveland Community

(Photograph from Ford Motor Company)

called rehabilitation is accomplished. Industry as a whole may never quite attain that ideal. But it can strive. And strive it will. For industry's obligations to the disabled veteran—already fully recognized by most managements—will constitute one of the foremost public relations responsibilities of private enterprise in the transition from war to peace.

True, there has been more planning than action—to date. But that is because there is still, fortunately, a greater need for accurate planning than for action. *The need for action will grow.*

It is for the possible assistance of the thousands of managements now engaged in such planning, therefore, that this article was prepared. It should be clear that it is an interim re-

port. Management's knowledge of the problem will grow with experience. Both fundamentals and techniques will then be more clearly defined.

Not to be overlooked, of course, is the considerable body of information already available through industry's long-time practice of finding jobs for handicapped people. Many phases of the two problems are identical, and the company with experience in the one has a long head start in tackling the other. Ford Motor Company, for example, (page 88), can draw on its 25-year experience. Caterpillar Tractor Company, on the other hand (page 91), is a typical case of companies that began their studies more recently and are now prepared to go ahead with plans for the rehabilitation of veterans.

The Fundamentals of Rehabilitation

For industry's guidance in forming the framework of its plans, the most important aspects of rehabilitation are:

1. Definition of Problem

Management should differentiate sharply in its thinking between veterans' rehabilitation and veterans' reemployment. The latter (see "Jobs After the War: Reemployment of Veterans," FACTORY, July, 1943) is a very broad problem of which the former is only one part. Congress has enunciated, society has assumed, and industry has concurred in, the national obligation to provide jobs to all deserving veterans.

But the deepest obligation by far is obviously owed to the *war-disabled* veteran, and it is he for whom the term "rehabilitation" should be reserved. That veteran may suffer unjustly if his cause is lumped indiscriminately with that of the veteran whose inherent, and usually slight, physical disability rendered him unfit for war; with that of the veteran who failed to make the grade in service life; or even with that of the veteran who, whatever his military record, is unharmed by the war and is therefore better able, physically and mentally, to take care of himself in the competitive world.

Interlocking but different sets of governmental machinery are being set up to encompass these different types of cases. The case that calls for the greatest degree of aggressive, voluntary action on industry's part is that of the veteran who lost his arm, his leg, his eyesight, his hearing, or his mental stability as a direct consequence of his participation in the war.

2. The Size of the Job

The veterans in need of rehabilitation, by the above definition, are still, comparatively, not numerous. Audited in one way, the disability of a single American is a shocking loss to the nation, not lightly to be dismissed. But there is the consolation that, at the time of this writing, our total casualties —killed, wounded, missing, and captured—in all branches of the service

The Arma Corporation, Brooklyn, adds man-hours to its score, gets a head start in rehabilitation by taking work to convalescent veterans in nearby hospitals. Twisting motion of screwdriver used in light assembly work will help wounded Marine at right to recover the full use of hand

since the start of the war have been about 140,000 against some 6,000,000 for the Russians, at least 4,000,000 for the Germans, and more than 500,000 for the British.

Of our 140,000 total casualties, some 46,000 are listed as wounded, 32,000 dead, 30,000 captured, 32,000 missing. We have every reason, of course, to fear that the number will grow terribly in time.

The above is said simply to offset a somewhat general misimpression arising from the statement, true enough in itself, that an average of 70,000 men a month are being mustered out of service, coupled with the statement that "half of these 70,000 came from hospital beds." The latter is probably true enough, too, but not in the sense in which it is generally taken.

Those 70,000 were mustered out, by and large, because of age, minor physical defects, routine physical ailments, or simple psychological unfitness for military life which is quickly and easily cured, as a rule, by disassociation from military life. The 35,000 monthly who "came from hospital beds" were there, by and large, for such things as appendicitis, hernia, pulled tendons, influenza, and other ailments common to civilians, though accentuated, perhaps, by the rigors of military training. The hospitalization rate of soldiers in the age group over 35, for example, has been 500 percent greater than that for the Army as a whole. Many men were hospitalized in the Army for the correction of physical conditions which they had neglected in civil life. Indeed, their continued induction was putting the Army in the position of rehabilitating the civilian population, actually placing a dangerous strain on the direct war effectiveness of the Medical Corps.

No one wishes to belittle these men or their service to the nation. But it should be understood that their employability and general fitness for civilian life were largely unchanged by their brief and bloodless contact with the war. Few of them need "rehabilitation" as a result of the war—unless they needed it before the war, in which case they probably need it less today.

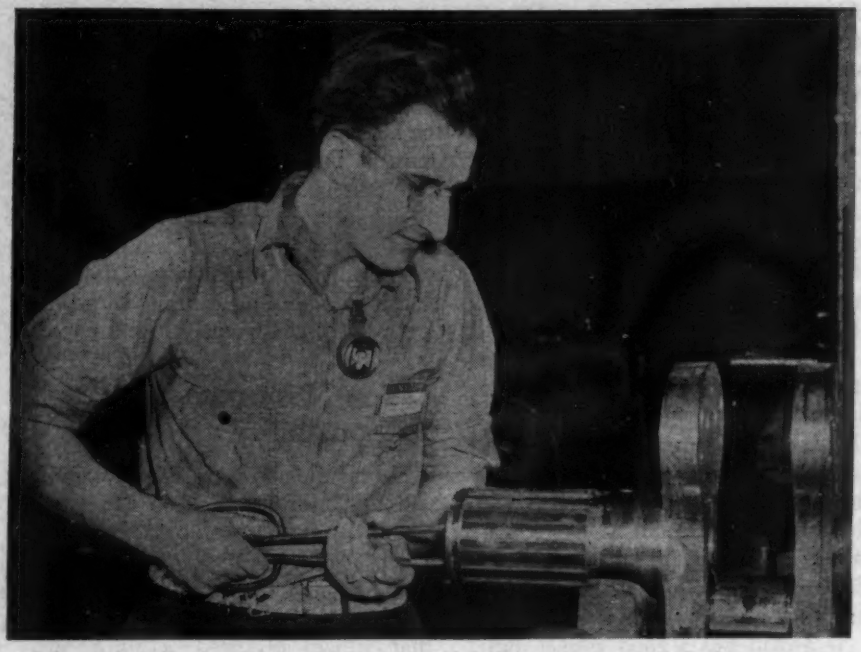
If a man was a good worker and a responsible citizen before he spent a few months in a training camp, he will be no less a desirable employee afterward. In fact he may have been improved as to character by military discipline. If, on the other hand, a man was a shiftless misfit before he entered the service, he will be only slightly less so when he leaves it. *His* "rehabilitation" is a job for society and perhaps for justice, but not for industry. He, incidentally, is one type—happily a small minority—who is likely to make the most fuss about being a veteran, to demand more preferential treatment from employers, and thus to prejudice the chances of the more deserving. Managements, of course, will give him an even break. But they have nothing to fear from dealing as firmly with him as they would with any other employee.

3. Top Management's Responsibility

For all the above reasons, it may be said that industry's role in the actual rehabilitation of genuine war casualties will probably not prove as formidable as it is sometimes depicted. This will prove particularly true of the company that utilizes advanced personnel procedures and maintains a fairly extensive medical department. For such a company, the task of relating the veteran to the job will be relatively easy.

Many companies do not, of course, maintain such services on any compre-

Special induction and transfer procedures have been set up at Eastern Aircraft. Here Dr. G. A. Eadie examines shrapnel wound that occasionally bothers Peter Truszkowski. Peter served two years in the Marines, was at Guadalcanal. Discharged from hospital, he now attends welding school



Ford Motor Company has already employed some 2300 veterans of this war, including 157 wounded. Walter Wielaba (above) served in the South Pacific for 13 months. Tropical fever ended his military career

Malaria brought Pfc. Lelon Grant back to the States. He is now learning to assemble B-24 parts

hensive scale. For them the task may prove to be much harder. Yet their obligation will probably not be lessened, for that reason, in the public eye —particularly their obligation toward their own former employees. This suggests expansion of medical and personnel departments—an expansion currently rendered difficult by the shortage of qualified personnel.

4. Part Played by Veterans Administration

Where, then, is the line between society's responsibility and that of industry in rehabilitation cases? It is still far from clear. The returning serviceman's life will be touched by the ministrations of many federal, state, and local agencies and organizations.

Among these are the Reemployment Division of Selective Service, chiefly concerned with the broad problem of seeing that veterans of all sorts get jobs, and represented in the field by reemployment committeemen attached to Selective Service local boards and by local reemployment committees in each community; the War Manpower Commission, now building an extensive Veterans Employment Service as an adjunct of its U. S. Employment Service; the Federal Security Agency's Office of Vocational Rehabilitation, which furnishes educational benefits to veterans; the Civil Service Commission; the armed services themselves; the American Red Cross; the American Legion; and countless state and local industrial commissions, vocational schools, and social agencies.

It is with the Veterans Administration, however, that industry's primary contact on rehabilitation will take place. This agency is charged, under Public Law 16, with restoring the disabled veteran to useful and productive civilian life. It administers the pensions and adjudges their payment in proportion to the extent of disability. Its function also includes industrial training.

The policy of Brig. Gen. Frank T. Hines, Veterans Administrator, on training is already well defined. The Administration will utilize established training institutions rather than set up any of its own, and will heavily emphasize training within industry. Through the pension system, the Veterans Administration will bear part of the cost of in-plant training. Pensions of veterans in training will be about $80 a month, and the cost-sharing formula is roughly this: The pension and the amount paid during the training period taken together must be equal at least to the Fair Labor Standards minimum of 40 cents an hour.

Employers interested in cooperating in this program should get in touch with regional field managers of the Veterans Administration which has offices in Montgomery, Ala.; Tucson, Ariz.; Little Rock, Ark.; Los Angeles and San Francisco, Calif.; Denver, Colo.; Newington, Conn.; Bay Pines, Fla.; Atlanta, Ga.; Boise, Idaho; Hines, Ill.; Indianapolis, Ind.; Des Moines, Iowa; Wichita, Kan.; Lexington, Ky.; New Orleans, La.; Togus, Me.; Fort Howard and Perry Point, Md.; Boston, Mass.; Dearborn, Mich.; Minneapolis, Minn.; Jackson, Miss.; Excelsior Springs and Jefferson Barracks, Mo.; Fort Harrison, Mont.; Lincoln, Neb.; Reno, Nev.; Manchester, N. H.; Lyons, N. J.; Alberquerque, N. M.; Batavia, N. Y.; and the Bronx, New York City; Fayetteville, N. C.; Fargo, N. D.; Brecksville and Dayton, Ohio; Muskogee, Okla.; Portland, Ore.; Philadelphia and Pittsburgh, Pa.; Providence, R. I.; Columbia, S. C.; Sioux Falls, S. D.; Murfreesboro, Tenn.; Waco, Tex.; Salt Lake City, Utah; White River Junction, Vt.; Roanoke, Va.; Seattle, Wash.; Huntington, W.

INVALUABLE IN CURRENT PLANS TO REHABILITATE VETERANS

Carl Kennel was a rear gunner on a PBY. Gunfire partially destroyed his hearing. Now suffering from shell shock, he was hired as a tool crib man

Loss of kneecap, arch, and finger is no handicap to ex-MP Pat McCann, 40, on his present job as a press operator in the Willow Run bomber plant

Va.; Wood, Wis.; and Cheyenne, Wyo. (Delaware activities are conducted from Philadelphia.)

Most of the Veterans Administration offices are located in veterans' hospitals. If an employer communicates with the regional manager and describes the specifications of the training oportunities he can offer, the Administration will send a representative to his plant.

Another Administration policy is this: It proposes to give veterans the most complete industrial training that may be possible in view of their handicaps, rather than lodge them within the confines of a single job. A further objective is to see that the veteran gets his training and finds his livelihood in his home community, if possible.

5. Treatment of the "Psychological Casualty"

There is a fine line to be drawn between exaggeration and underemphasis in any discussion of the psychological casualties of war.

First there is the danger that too much apprehension will develop among employers over the number and complexity of mental problems which the returning veterans may pose. Alarming inferences, like the "35,000 a month returning to civilian life from hospital beds" may be drawn from the existing statistics.

Actually, the number of war-incurred psychological casualties is as yet relatively small.

To begin with, a distressingly large proportion of *civilians* are not perfectly balanced of mind. Some 20 percent of all rejections for military service (the so-called "psychological 4-F's") have been based on mental grounds.

For the same reason, and generally for no other reason, a large proportion of today's veterans are not perfectly balanced, either. Many a psychological 4-F slipped through the nets of the examining physicians at the induction centers and got into the service where it was soon discovered that he simply wasn't fit psychologically for the life of military discipline and the rigor of battle. This is no reflection either on his employability and or his mental fitness for civilian life.

As a matter of fact, about 23 percent of those currently being discharged from the service are being turned out because they were temperamentally unfit for war. With few exceptions, the mental instability of this group was not acquired in the service, will not carry back into civilian life, and does not constitute an authentic "rehabilitation" task for industry any more than do the flat feet, the hernias, and the gall bladder cases who return to industry as "disabled" veterans.

Modern battle action does, of course, leave fearful mental scars. The incidence of genuine "battle fatigue," formerly called "shell shock," is higher in this war than in the first World War, and the degree of derangement is often more formidable than it has been in the past.

But the best of psychiatric treatment awaits the veteran in the government hospitals. Modern techniques have produced some astonishing recoveries. *Moreover, the Army, the Navy, and the Veterans Administration do not propose to release a man from treatment until he is genuinely ready for the next step in rehabilitation.* Thus the number of out-and-out war-induced psychoneurotics who have returned to civilian life is—and will continue to be—very, very small.

Sheer "nervousness" is another matter. Nervousness is a trait of any veteran who has seen combat action, whether wounded or not. It frequently,

offers the employer something to contend with when he undertakes any real rehabilitation job. The treatment of the "whole man" is, of course, the secret of any kind of rehabilitation. This suggests the use of psychiatric specialists in the plant—a policy that is likely to be widely adopted by industry in the future.

The first step in psychotherapy, of course, is the job itself. The job often removes the feeling of insecurity which is at the bottom of the veteran's apparently unrelated broodings, resentments, and depressions. The second step is a coordinated effort on the management's part to show a friendly, sympathetic—not necessarily soft or sentimental—interest in the veteran as an individual.

Much will depend on supervision. Here are the words with which a General Motors psychiatrist asks foremen to exert their personal influence in the "moral rehabilitation" of returning servicemen:

"It isn't easy to make a good comeback mentally and morally after one has been trained for some time(and in many cases has practiced) the arts of killing one's fellow-humans. Many of these boys have seen their comrades mangled and killed, and have been trained to hate and to seek revenge and to go after their objective ruthlessly, regardless of the means. It is a real battle for these men to return successfully to the comparative stability of civilian life with its conventions, laws, and morals. If they are to win, it will be largely through the kind of moral climate they find in the plant."

6. Doing the Job With Insufficient Data

The government is not likely to change its policy of keeping confidential the detailed data on a veteran's disability. Occasionally the authorities may be induced to supply details if the request from the management is supported by the veteran himself. But, by and large, these data will be withheld, especially if there is any chance that they may damage a man's chances of employment.

Thus plant physicians must be retained to examine each applicant with the utmost care. And, again, the likelihood is growing that examining psychiatrists will have to be retained to determine the individual's psychological suitability for a job.

Case Material in Rehabilitation

FORD MOTOR COMPANY

Ford's long-standing peacetime policy of hiring a proportionate number of handicapped persons now stands the disabled veteran in good stead. Ready-made machinery is at hand.

In the past 25 years, in fact, Ford has handled nearly 12,000 cases of a rehabilitation character. And in this war to date it has employed 2321 veterans—about 90 percent pre-war Ford employees—who are suffering from disability of some sort and of whom 157 were wounded in combat.

All hires having disability features must clear through the medical transfer department, an adjunct of the medical department. First step after hiring by the employment department is a physical examination by the medical department, during which disabilities are noted on the back of the employment card which is then sent to medical transfer. Here a "sticker" card and duplicate "disability" cards are filled out, plus a "returned veteran's medical investigation" card. Records of the veteran's employment with Ford are then carried not only in the company's central personnel file, but concurrently in a veterans' file and in a disability file where subsequent changes in status are noted.

Medical transfer also carries a complete file on the character and physical demands of the work done in every corner of the company. The department's staff includes six "investigators," four men and two women.

These investigators are old hands at matching disabled men to suitable jobs and capable "salesmen" in convincing foremen of the wisdom of hiring handicapped workers. They rove the plant constantly searching for job opportunities for their new clients and keeping in touch with their old ones.

Chance to Check Up

Not much is left to chance, however. Say that a veteran—because of unsuitability, difficulty, dissatisfaction, or a desire to improve himself—succeeds on his own initiative in arranging a transfer from one department to another. Medical transfer is automatically notified of the change by central personnel (where the manila envelope containing the employee's entire record is marked, remember, with note of his disability status). Medical transfer thus gets a chance to check whether the transfer is logical or whether another one should be arranged.

Ford classifies its disabled veterans in two groups: (1) "Inactive Servicemen," those discharged within the continental United States (as of January 4, 2164 in number); (2) "Active Servicemen," those wounded in active combat (157). Thanks to its complete filing system, the company is able to furnish data of real value on the character of disabilities encountered.

Flat feet and fallen arches, to the number of 80, are the leading types of disability in an anlysis of 653 "inactive servicemen" cases. More formidable disabilities are found farther down the list, which includes "nervousness," 55 (as distinguished from outright psychoneurosis, of which 11 cases are listed); stomach ulcers and disorders, 45; old injuries, 30; poor vision, 27; arthritis, 23; asthma, 17; back injuries and bad back conditions, 20; sinus, 18; heart trouble, 14; perforated ear drums, 15; headaches, 13; kidney conditions, 11; and fractured knee caps, dislocated knees, and so forth, 10. There are 63 classifications all told, but all those of which there are 10 cases or more are listed in the foregoing.

Analysis of 87 "active service-men" cases shows that there are 47 classifications with, for the most part, only one or two cases apiece under such headings as "leg, back, chest shrapnel at Guadalcanal," or "right eye and wrist injured, shrapnel." But the most numerous causes are "nervousness," 11; malaria, 6; stomach ulcers, 7; sinus condition, 4; heart condition, 3; old injuries, 3; punctured lung (shrapnel) 3.

NAME Doe, John Service Status Active x Inactive Date 11-23-43

Age 32 SS#375-07 Badge No.

Reason for Discharge: Navy (x) Army ( ) Marine ( ) — August 25, 1943 because on intracranial injury received during action at sea.

Service Record: 16 months in Navy (4½ months' sea duty). Was on the U.S.S. Wasp which was sunk 9-15-43 and received intracranial injury at that time in line of duty. Was sent to hospital in New Hebrides, then was brought back on Hospital Ship to a hospital in California.

Disability: Head injury while in service

Previous Dept. 1519 Reinst. 1516 Trans. H.P. Classification: Coldheading

Present Dept. same Classification: same

Percent Disability for Previous or Regular Work: See above

Status: Rehire ( ) Reinst. (x) New Hire ( )

TRANSFER SLIP

ISSUING BRANCH OR PLANT DATE 1/15 1944

NAME Doe, John OLD NO.

FROM DEPT. 1516 AS Screw Mach.

TO DEPT. 505 AS Bench Assy.

EFFECTIVE 1/24 1944 RATE NEW NO.

REASON Too much noise, headaches

REPLACING INSERT NAME RATE

SIGNED APPROVED

SUPERINTENDENT-MANAGER DEARBORN OFFICE

Ford leaves nothing to chance, has set up a special department and special records to take care of all hires with disabilities

One of the most thought-provoking aspects of this analysis, indeed, is the fact that, while the "active servicemen" are listed as wounded in action, a large proportion of their disabilities appear to be disassociated from their actual wounds and resemble in character those of the larger group. There are also one or two cases apiece of arthritis, old knee injury, poor vision, hernia, and so forth—including 6 men over-age and 2 discharged for bad conduct.

No special departmental set-up has been created for the handling of "nervousness" and psychoneurosis as yet. Such cases are handled individually and may come to medical transfer for additional attention either on request of the foreman or of the man himself. Transfers are adjudicated after physical examination in the same way as other cases. Of the 11 "nervousness" cases among "active servicemen" at River Rouge, only one original placement has come back for transfer.

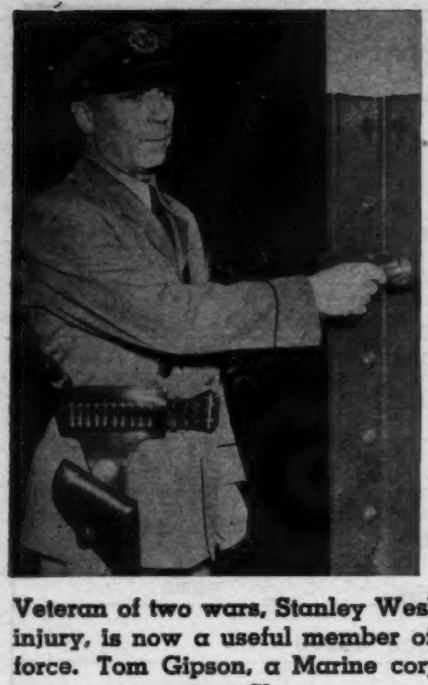
In general, it appears that noisy departments are those in which the "nervous" cases experience their greatest difficulty.

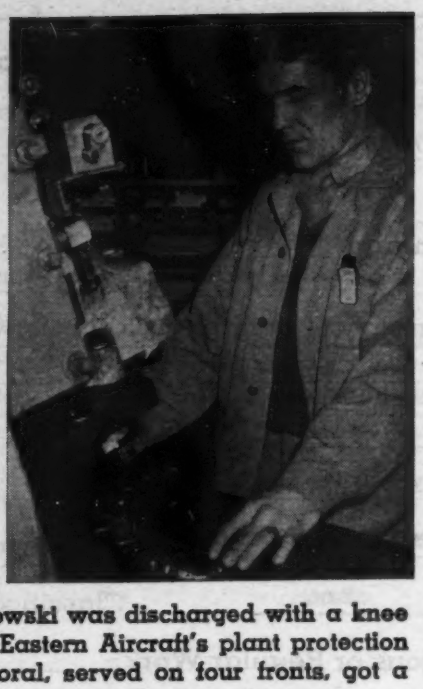
EASTERN AIRCRAFT

Here is a typical case history taken from the files of Eastern Aircraft, Linden (N. J.) Division, General Motors Corporation: "X——— is 25 years old. He was discharged from the Army due to shrapnel wounds of the left wrist and right knee and concussion sustained in action in North Africa. He participated in five missions and three major battles. He was hired by Eastern Aircraft on September 24, 1943, as a tool crib attendant. When first hired, he was somewhat nervous, but has improved considerably since. He is doing a very good job, is a conscientious worker, and seems contented."

Another: "Y——— is 30 years old. He entered the service 9 years ago. In 1942, while in the Marine Air Corps as a flight mechanic and radio gunner, he was stationed in the Samoans and may have been in action in the Solomons. The next thing he remembers is being in the hospital at San Diego for treatment for 'nervousness.' He received Metrazol shock therapy and made a good recovery. He entered the employment of Eastern Aircraft on May 7, 1943.

"He was first employed as a riveter. However, he became nervous on this job and was transferred to a flight me-





Veteran of two wars, Stanley Weslowski was discharged with a knee injury, is now a useful member of Eastern Aircraft's plant protection force. Tom Gipson, a Marine corporal, served on four fronts, got a severe concussion. Shown at press, he now works as an inspector

chanic's job at the airport which he liked very well. In October he became quite nervous again because his parents were going through a separation and he was given a leave of absence for two weeks. Upon his return he felt much improved and since then has been made leader of three or four men at the airport. The situation at home has improved in that he is now living with his mother away from his father.

"The first job we placed Y—— on is a good example of very poor placement. Here is a returned soldier discharged for 'nervousness' and still we place him on a riveting job which happens to be one of the noisiest in the aircraft industry. Naturally Y——— was a complete failure on this job, whereas on his present airport job he is considered a very definite success."

And still a third case: "Z——— is 20 years old. He was a former drug addict, admits he used morphine, marijuana, etc. He entered the Army early in 1943. He did not like the Army and did very poorly. He was AWOL three times altogether while in the service. Became quite nervous, especially while on the rifle range. He was employed at Eastern Aircraft on September 6, 1943, at rack and unrack work. His work was unsatisfactory and he adjusted very poorly. He voluntarily quit in September, 1943. He seemed to have the attitude that 'the world owes me a living'."

Genuine concern over the "misfits" typified by Z——— is expressed by A. A. Hendrix, director of personnel at Linden.

"We must not allow this group to cast a stigma or reflection on all returned soldiers," Hendrix warns. "This can so easily happen since the foremen out in the plant, unless we are very careful, will class all returned soldiers as a group."

A key point in Eastern Aircraft's program, incidentally, is the education of foremen and supervisors to their vital role in the rehabilitation of the individual veteran. Each foreman is given a full explanation of placement procedure:

1. Regular hiring routine augmented by an initial, cursory effort by the interviewer to determine the veteran's physical, mental, and emotional status and tentatively to select a suitable job for him.

2. Medical examination and filling out of veterans' hospital card, after which the physician reviews the interviewer's proposal of a specific job. Informal teamwork is the rule here. For example, the doctor rejects the suggestion that a man with varicose veins be assigned to a job as a metal former, which involves constant standing in one spot. The doctor then confers with the employment interviewer, and it is agreed that the man should work in the stock department where he will be able to sit down occasionally.

3. Acceptance or rejection. The company will occasionally turn down a veteran if it does not believe him ready for work or if it cannot provide an entirely suitable job.

4. Induction. Here the company's educational department takes a hand. Initially it helps to condition the veteran psychologically for his new job; later it follows his progress, helps him to take advantage of vocational training opportunities, such as enrollment in the General Motors Institute at Detroit.

Finally, there is an established transfer procedure. The employment office has assigned men especially to follow through on this. The medical department, after consultation with the employment office, determines whether or not a transfer is justified and how it may best be effected. The company deals firmly, however, with those it suspects of "trading" on service records or exaggerating physical defects.

Thorough familiarity on the part of the foreman with all these procedures is strongly stressed. It is the foreman who has the most contact with the veteran and the best opportunity to observe him in daily life. Training in rehabilitation is being made an integral part of the division's supervisory training program.

"We hope to train supervision to detect the early signs of mental and emotional trouble, and also to observe signs of ill health, nervous strain, and worry in 'normal' workers," says Dr. Gordon A. Eadie, plant physician. An industrial psychiatrist, Dr. Eadie believes many failures in rehabilitation may be averted if the management makes itself a friend to the veteran, learns his interests, his background, his worries, hopes, and ambitions.

In training supervisors to work with the veterans, Dr. Eadie further points out, "we are actually preparing them to handle any sort of personality problem they may encounter."

General Motors has not completed an analysis of the types of disability noted among the 672 veterans it has hired at Linden, but believes a good 30 percent of them fall within the category of nervous disorders, functional or organic. As a psychiatrist, Dr. Eadie can advise supervisors on the right thing to say to jittery veterans at the right time. His office is always open. He is not officially known in the plant as a psychiatrist.

ARMA CORPORATION

The concept of taking the work to the convalescent veteran originated with this Brooklyn manufacturer.

At Brooklyn Navy Hospital and at St. Albans Hospital, another Navy institution in nearby Queens, you will find wounded men—some bedridden and some, in fact, in plaster casts—who are already enrolled as Arma employees and actually at work. They can assemble small parts, crimp terminals on cables, and even do light riveting jobs. They work (during limited hours, of course) at the regular piece rates that would be paid in the plant.

Let R. F. Nelson, Arma vice-president, whose particular "baby" this program is, tell it his own way:

"A blond-haired boy from Iowa, who is lying in a plaster cast from his ankles to his chest, is engaged in making precision parts for motors. There is a lad alongside this first one who is intensely interested in gyro compasses. He is engaged in hand operations and subassemblies of gyro compasses, and by the time he is discharged he will be well versed in this kind of work. There is another lad from Vermont with a paralyzed leg suffered in the Pacific. He has an unquenchable desire to become an expert turret lathe hand."

The therapeutic value of the work is hailed by Comm. H. B. Arnold in charge of physiotherapy at Brooklyn Navy Hospital, as a promising advance. Commander Arnold is pleased both by the improved mental outlook of his patients and by the variety of restorative exercises that industrial operations of this sort can offer.

Pfc. George Bubelnik, for example, is a Marine whose upper left arm was smashed by a Japanese explosive bullet somewhere in the Pacific. A miracle of surgery repaired the shattered bone and torn muscles, but the arm is still weak and thin. For his use, Arma brought a simple hand punch to the hospital. The punch requires a special motion that ideally exercises the weakened tendons and muscles.

Arma's director of training, George Wigle, spends a good deal of time at the Navy hospitals working out new jobs for the patients in consultation with Commander Arnold and Ensign Harriet Jones, occupational therapist at St. Albans.

Jobs in the plant await any of the hospital "employees" who want to go on working for Arma after their discharge from the hospital and the Navy. The company has few disabled veterans in the plant now, but Personnel Manager Paul Dorn believes it can handle any logical volume of them in stride, because it already has a well-developed technique for induction of handicapped workers. The plant medical department is staffed by 9 consulting physicians and 20 nurses. The personnel department, which includes a sizable staff of personnel counselors, has worked out detailed job descriptions for collaborative use with the medical department.

CATERPILLAR TRACTOR

This Peoria, Ill., company has an 18-month head start on the veterans' rehabilitation problem.

With 5000 stars in its service flag, Caterpillar reasoned that it would some day face a rehabilitation task of real proportions. So, in mid-1942, it began to recruit large numbers of handicapped civilians, more than 800 in all.

Induction and training procedures thus developed will enable the company to greet its disabled veterans with a tested, well-coordinated program for their swift return to self-sustaining civilian life.

First step was a department-by-department survey in which supervisors were asked to list the minimum physical requirements of each job. This revealed that there were 1000 distinct

Caterpillar Tractor is another of the many plants whose experience in finding jobs for handicapped people will stand disabled veterans in good stead. Two of the men shown here were injured in civilian accidents; third is Charles W. Craig whose left leg was practically blown off at Pearl Harbor

jobs in the company's plants. The personnel department was then instructed not to reject any applicant on physical grounds since, among the company's 1000 jobs, there must be one the applicant could fill, no matter what his handicap.

Caterpillar writes a stringent definition of "handicap," by the way. It excludes hernia, hay fever, missing fingers, slightly defective vision, and so forth, and includes only such pronounced disabilities as missing limbs, marked deformities, loss of one or both eyes, loss of hearing and speech, organic heart disease, and the like.

Steps in induction are: (1) Initial interview, (2) job assignment based on job analysis, (3) medical examination and approval of assignment, (4) training. Special instructions in the handling of the individual are prepared for the supervisors by the medical and personnel departments. Special safety instruction has been worked out, and is given the employee.

Rehabilitation Techniques

The handling of recently handicapped persons, such as accident victims, has received special attention because of Caterpillar's desire to develop techniques for veterans' rehabilitation. For example, Lloyd Smith, who lost his arm in a hunting accident, now supports his wife and child as a clerk in the reclamation department. Arthur Russell, a stock chaser, makes more than double any amount he ever earned as a bookkeeper before he lost his hand in a motor crash.

Caterpillar's first and, to date, only, disabled war veteran is Charles W. Craig, 26, whose left leg was all but blown off by a Jap bomb at Pearl Harbor. On a bench job in the machine shop, he does a good day's work, though he must remain seated.

Craig found his Caterpillar job in less than three weeks after he finished 528 days in army hospitals. That is important in the opinion of Dr. Harold A. Vonachen, company medical director, who says:

"Those suffering from nervous disorders on returning from military service will present a problem of some magnitude, but certainly many of these men will recover if we are able quickly to absorb them into an occupation that will convince them they are fully capable of caring for themselves and their dependents."

CLEVELAND COMMUNITY

There is some evidence that industrial employers will join forces with government and private agencies in community-wide efforts to insure the prompt employment of disabled veterans on suitable jobs.

The Occupational Planning Committee of Greater Cleveland, for example, has launched a subcommittee on post-war occupational problems to prepare a directory describing all the special agencies, public and private, that stand ready to serve returning veterans in their efforts at occupational adjustment. The directory is intended primarily for the use of the volunteer reemployment committeemen, attached to each Selective Service local board, whose task it is to greet the returning serviceman and guide him into a job.

The worth of such a directory, in almost any large community, can hardly be overestimated. There is almost no end to the number of private social agencies, quite outside the federal government (20 are represented on a single committee in Cleveland), prepared to give some sort of vocational, educational, or social assistance to the veteran and his family.

Another useful activity of the Cleveland Committee is a report prepared by its subcommittee on occupational problems of the handicapped.

This report, based on data supplied by three Cleveland manufacturers, lists samples of the types of occupation that can be found for men suffering from corresponding types of disability.

Another beneficial activity is reported in the Cleveland area, where representatives of the federal government agencies themselves have completed a series of 26 meetings designed to acquaint each with the other's function. Personnel of Selective Service, the United States Employment Service, the United States Civil Service Commission, and the Veterans Administration took part in these meetings. Each thus gained a clearer idea of his own and the other fellow's role in the big job of rehabilitation that must soon be faced.

There is a growing feeling among personnel men that industry should begin now to develop closer local contact with groups of the sort described above. Management might well consider the assignment of a representative to explore every possible liaison and detect every possible duplication in the services extended by society to the veterans on the industrial payroll. One obvious benefit would be the discovery of agencies capable of solving the out-of-plant social problems which may sometimes delay the rehabilitation of the veteran within the plant.

Matching Handicaps With Jobs

Data from three Cleveland companies

Job	*Handicap*	*Job*	*Handicap*
Auto Mechanic	*Weak Condition	Machine Operator	*Stomach Ulcers
Cold Roll Man	One Eye	Machine Operator	*Nervousness
Gateman	*Poor Vision	Machinist	Hand Injury
Guard	*Arm Injury	Machinist	One Eye
Guard	*Nervousness	Machinist	Hernia
Guard	One Eye	Oiler	*Hernia
Laborer	Sinus	Routine Tester	Eye Injury
Laborer	*Nervousness	Sweeper	Injured Back
Laborer	*Spinal Curvature	Sweeper	*Hip Injury
Machine Operator	*Poor Eyes	Time Checker	Heart Condition
Machine Operator	*Fallen Arches	Tool Crib Man	Foot Injury
Machine Operator	*Arthritis	Truck Driver	*Foot Injury
Machine Operator	Head Injury	Window Washer	Hernia
Machine Operator	*Fractured Skull	Window Washer	*Nervousness
*Veteran			

Using Work Simplification to Salvage Man-Hours

Omaha Public Library
Reference Dept.

ROSCOE R. NICODEMUS, Industrial Engineer, Johns-Manville, Manville, N.J.

Does material and manpower shortage stop work simplification? The answer at Johns-Manville is "no."

Comparatively few of our supervisors' ideas for improving operating methods through the application of work simplification principles have had to be laid aside for the duration. It is true that shortage of materials and manpower occasionally makes it necessary to "shelve" an improvement until these things are once more easily available.

However, for the most part our supervisors have turned their efforts toward the smaller projects—improvements which do not require excessive use of critical materials. They have learned from experience that applying the principles of work simplification to the operations they supervise is one of the best ways of helping themselves out of a manpower shortage problem.

Everyone likes to "make the headlines" with a methods improvement that will result in a five- or six-figure saving. We know, however, that the accumulated savings from all the small improvements will, at the end of the year, almost always exceed those of the more sensational headline jobs.

Simplifying Small Jobs

The foremen are beginning to realize more and more the importance of cleaning up the small jobs. We have found that these so-called small improvements often result in tremendous savings in vitally needed man-hours. In addition to the labor savings, there are substantial savings in materials.

The nature of our industry is such that we have little assembly work, but we have found many operations to which we could apply the principles of work simplification.

For instance, one supervisor, after analyzing and questioning the method of manufacturing a fitting to be used with asbestos cement pipe, hit upon an entirely new method of manufacture. The new method will not only produce a better product, but will free a critical machine for use on other products. There is a substantial saving in man-hours required per fitting and a 50 percent reduction in the number of rejections at final inspection.

In another case, the shop foreman found that by using a special chuck on the planer, it was possible to machine a forming mold in two hours—an operation that had previously taken a skilled mechanic two days to do by hand. The chuck was made in our own shop at small cost.

Plant layout also has been made a phase of our work simplification program. In regularly scheduled meetings of foremen and sub-foremen, templet layouts were made available for study and discussion. Projects involving plant layout were analyzed and discussed by the groups. With the templet layouts it was possible for the men to get a comprehensive picture of the problem and the proposed improvement, not only as it affected one particular operation but also with regard to the entire process. By the simple expedient of moving the templets (all drawn and cut to scale) about on the layout, they were able to study the effects of any proposed change on working areas, handling, storage, and continuity of materials flow. In this way, all supervisors whose departments were in any way affected by a change, were fully cognizant of all phases of the change before it was started.

One example, a simple improvement that saved many hours, is the use of a tray for counting and stacking a small wedge-shaped circular packing. In the old method, the operators trimmed the inside and outside diameters with scissors, inspected, and stacked the packings in piles of ten pieces each. When the table in front of the operator was full, she placed the required number in a carton. As might be expected, plenty of re-stacking and re-counting were necessary in the course of a day's work. A light but sturdy tray was constructed of wood and fiberboard. This tray consists of eight spaces, each of which is

After trimming and inspecting circular packings, operator used to stack them in piles of ten. Plenty of re-stacking and re-counting were necessary. Now she places pieces in a slotted fiberboard tray. Each slot holds 50 pieces, and no stacking by hand is required

In the old method of packaging small ring packings, rings were placed over a peg with one hand, and formed around the peg with the other. When the peg was filled, rings were put in carton. New method uses a jig with 25 pegs, operated by pedal, which automatically forms the rings

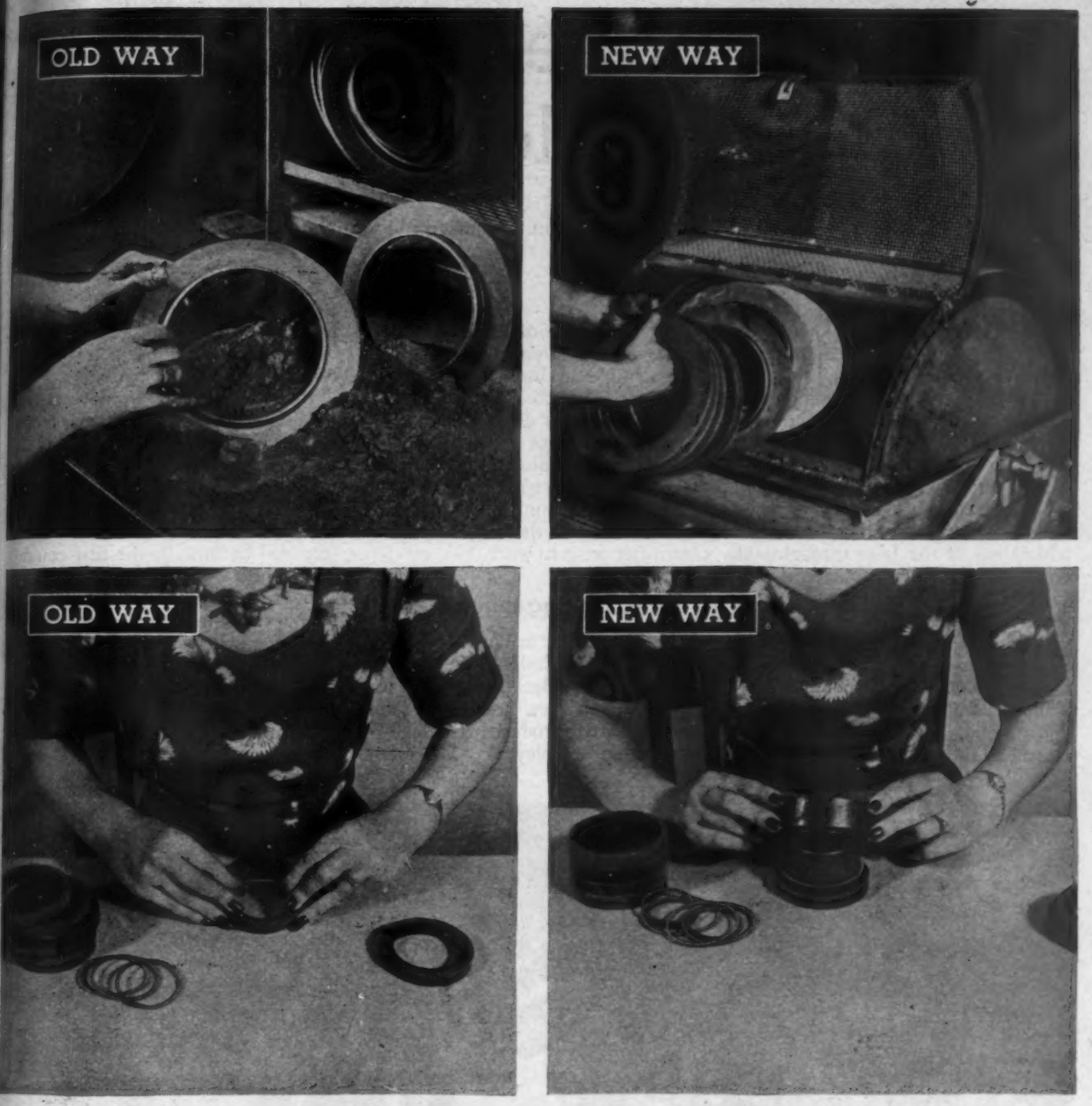
long enough to hold exactly 50 packings. When the tray is full, the packings are transferred to the carton. No time-consuming stacking is necessary, nor is it necessary to count the pieces for packaging and production records.

Another example of an improvement that resulted in saving many hundreds of labor hours, was the one made in the method of packaging a small ring packing. In the old method, the rings were placed over a peg with one hand and formed around the peg with the other. The packings were dipped in a lubricant in the preceding operation which caused a slight expansion at the cut. This made the forming necessary. When the peg was filled, the rings were transferred to the carton.

In the new method, we use a simple jig consisting of 25 pegs set in a slotted steel plate in such a manner that they are opened and closed by a pedal. This makes it possible to use both hands for placing rings on the pegs. When closed, the pegs form a perfect square which automatically forms the rings. The bottom of the carton is slipped over the pegs, and rings are removed by lifting up the thin metal back plate. The new method resulted in a considerable increase in output.

Another example is one supervisor's improvement in the method of surfacing packings. A cylindrical screen, large enough to accommodate 50 to 100 packings, is used to "tumble" the packings in a surfacing material. The result is a saving of many man-hours over the old method of surfacing each packing by hand. In addition to the labor savings, better control of the material was made possible, and working conditions were greatly improved.

The possibility of creating employee good will through methods improvements is an angle that should not be overlooked. In this surfacing project,



No more hand surfacing of packings since the cylindrical screen (top, right) that "tumbles" the packings was installed. The old method of assembling a small metal spring into a packing (bottom, left) resulted in many finger injuries. Now a two-piece jig is used, saves nails and tempers

the improvement in working conditions resulted in a better worker attitude, which has a real value.

Still another example was the assembly of a small metal spring in the lip of a packing. The old method was to force the spring into the groove in the packing with the fingers. Because the spring was fairly stiff, considerable pressure was necessary to stretch it enough to fit into the groove. As a result, finger injuries were frequent and broken finger nails were a cause of almost constant complaining.

In the new method, a two-piece jig is used. The bottom half of the jig fits into the inside of the packing. A tapered shaft makes it easy to slip the rings onto the jig, and the top half, when placed over the tapered shaft, forces the ring into the groove with only a slight pressure. The resulting increase in production was sufficient to be important; but of even more importance was the fact that the operation was made easier and safer.

These are just a few examples of the many ways in which our supervisors have used their training in work simplification to good advantage.

The many demands made on their time by new supervisory responsibilities, and new problems arising from increased production to meet the war needs, do not permit their spending as much time as is usually necessary to develop the larger projects—projects involving major changes in equipment or layout. These must necessarily become engineering projects, although in many cases the original idea came from a production supervisor.

The questioning approach and the application of the principles of work simplification, as aids to overcoming difficulties arising from material and manpower shortages, have almost unlimited possibilities.

Labor-Management Team in a Small Plant

NEIL KENNEDY, Personnel Department, American Welding & Manufacturing Company, Warren, Ohio

THE RELATIONSHIPS of a small war plant with its labor-management committee have none of the departmentalizing, impersonality, and remote control that characterize the more top-heavy organizations of our industrial giants.

Our company, for instance, employs less than 1000 people. We make welded steel rings for war materials.

Members of the labor-management committee are on first-name terms with practically every other employee in the place. There are very few "misters" at American Welding, from the factory aisles right up to the front office. Members of the committee, labor and management representatives alike, are "Steve" and "Joel" and "Frank" to the rest of the personnel.

When it came time to form a labor-management committee the president of the United Steelworkers of America, Local 1574, selected eight members representing major departments in the plant. Management picked four representatives. The union president and a personnel department member were elected by the committee to serve as co-chairmen, and that was that. The committee went to work.

First, a Suggestion Plan

Selecting as its first activity a suggestion plan to develop more and better ways to make the plant's war production cheaper, faster, and safer, the committee produced a deluge of ideas from employees. Suggestion boxes distributed through the plant brought in suggestions upon which the committee members passed.

In a small plant, prompt action is required on every idea that comes along. The members of a small plant's labor-management committee do not have an insulating bulwark of formality behind which to retire. The proud papa of what seems to him a brilliant idea will buttonhole the first committee member he can find and demand to know what's doing! It is to the credit of our labor-management committee that it has been able to work out a reasonably quick procedure for handling employee suggestions—one that seems to satisfy almost everyone.

A subcommittee of three members handles the preliminary work on all

In the hands of the labor-management committee, the annual company picnic far outdistanced previous efforts sponsored by the management alone or by the union alone. Everyone had fun

Getting solidly behind the blood donor campaign, committee members canvassed the entire plant, and produced the largest enrollment group in the community. One department signed up 100 percent

suggestions. A suggestion favorably reported by this committee is assigned to a member of the labor-management committee for a thorough check in his department. Careful check with other workmen, foremen, and engineers sometimes indicates that the idea has merit, despite adverse opinion of supervision. In that case the labor-management committee can still recommend the idea for trial and an award, and does so. In the usual instance, however, the idea is welcomed by all concerned and passed upon for adoption and cash or bond recognition. The committee makes itself responsible for the recognition, and for pushing the idea regardless of origin.

Personal contact between committee members and the rest of the employees was also a major factor in the next item on the labor-management program. Getting solidly behind the blood donor campaign, committee members canvassed the entire plant and produced the largest enrollment group in the community. Dwarfing the turnout of much large plants in the same area, our representation included one department which signed up 100 percent. The local papers took special note of this performance, which was, in part, a result of an employee rally staged by the committee and addressed by two veterans of Guadalcanal, both of whom had benefited from blood plasma treatment for battle wounds.

Similarly, the annual company picnic, in the hands of the labor-management committee, outdistanced previous efforts sponsored by the management alone or by the union alone. With patriotic sincerity, the committee discarded all distant picnic spots requiring automobile transportation and selected a local municipal park which could easily be reached by everyone. With games, fun, and prizes for everyone, young and old alike, the committee put on a picnic unusual in the amount of personal responsibility assumed and fulfilled by individual members. Here, again, the element of close personal contact in a small plant is effective. If Ed is responsible for beer and Joe is expected to furnish the music, both beer and music had better be on hand and of the best quality. Otherwise Joe and Ed are going to hear about it promptly and in person, not once, but hundreds of times.

It Pays to Be Present

In its drive for "presenteeism" (which the committee favors over the more negative term of "absenteeism") the labor-management group has shown an unusual understanding of the problem. Recognizing that an increasing number of women workers have their own perfectly understandable domestic reasons for not being on the job, the committee has offered the ladies—and their husbands, too—sporting inducements to ring the time clock regularly. At frequent intervals the labor-management committee rigs up a table of prizes at the factory gate and holds a "presentee" drawing. The prizes are coffee-maker sets, waffle irons, and similar merchandise. Members of the incoming and outgoing shifts gather around. Each employee's name and clock-card number goes into a barrel, from which a blind employee draws them, one by one, as long as the prizes last.

It is a great feeling to have your name drawn in front of a crowd that includes all your fellow-workers. The prizes look pretty good; and it is a very pointed let-down when the personnel director runs his pencil over the list, finds you have been absent, and calls for another name. But, in a small plant, there is a good chance that your name will come up again in the next drawing. The labor-management committee figures that if it does, the disappointed absentee of the previous drawing will be the "presentee" who takes home the waffle iron he should have had last time!

Absenteeism is on the decrease at American Welding as the committee's emphasis on "presenteeism" takes hold. Group approval of being on the job, plus an occasional unexpected award in the prize drawing, has changed the slant of most employees. Obviously, under the labor-management committee's plan, it is no longer smart to take a day off now and then just for the fun of it.

Feeling that it needed a better

So that everyone in the plant and the community could learn how the labor-management committee operates, it "took to the air"—held a typical meeting over the local radio station

medium than posters and bulletin board announcements by which to carry news of its activities to the employees, our labor-management committee next suggested a plant paper. The idea was approved and the committee sponsored a campaign for a name. The "Ring Leader" won the prize. The paper itself got off to a flying start under committee sponsorship and has proved to be a real morale builder. Full of personal items from every department, and with plenty of photographs, the new publication has proved to be an effective link between departments, and between an increasing number of employees in the service and their fellow-workers back home.

Once more the intimate contacts of a small plant proved responsible for real performance. If the committee's reporter in a department does not turn in news items, the fellow-workmen in the same department are likely to be critical. Even foremen have been known to suggest, pointedly, that their departments deserved a little more publicity than their reporters seemed to be giving them.

Well into stride in its first few months of existence, the labor-management committee undertook the Second War Bond drive with signal success. It has also broadened its suggestion campaign to include ideas for new post-war products. The committee is looking for products for the plant's war-sharpened skill, experience, and production facilities. It maintains that the men who run the machines should have some practical ideas as to what can be made on them, and is joining its efforts with the engineering and sales development departments to stimulate those ideas by an extension of the suggestion plan.

Finally, the labor-management committee at this small war plant took to the airwaves to acquaint the community with it work. Holding a typical committee meeting before the microphone of a local radio station, with all but one member present, it staged a working example of its activities for listeners. By means of reports from various committee members, it brought its program up to date in a 15-min. broadcast which had been well advertised throughout the plant. Again, Steven and Joel and Frank made the most of the close personal relationships in a small plant. Few fellow-employees wanted to miss hearing the boys on the air; few missed telling them the next day how lousy—or how unexpectedly good—they proved to be in front of the microphone.

In this plant the doings of the labor-management committee have become of warm and personal interest to almost everyone in the plant. Squawks? Sure, there are plenty of them. But the "voice of the people" has an immediate outlet to and through the committee members. And there is high praise too, lots of it, for the job the committee members are doing in stimulating vital production.

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Address the Editor

Control by Chart of Small-Parts Production

A. L. PISTRICH, Production Engineer, The F. W. Sickles Company, Chicopee, Mass.

THE SYSTEM of production planning and control we use to govern the manufacture of radio parts will be of special interest to those who face the problem of controlling the output of small units which include subassemblies produced either completely in a subsidiary department or in a progressive series of functional departments.

Eighteen departments are involved in the project. These units are shipped to two companies, *A* and *B*, simultaneously. There are 39 units, with about 110 subassemblies and sub-subassemblies. Two of the units are used also as subassemblies by us. In addition, some sub-subassemblies are common to some subassemblies. Also some subassemblies are common to some of the final assembled units, and some of the final assembled units are common to several different radio sets.

Production is on a functional and line basis. All final assemblies are on a line basis; subassemblies and sub-subassemblies, on a functional basis. The functional departments include such operations as winding, riveting, testing, and soldering.

We felt that the use of functional departments assured best utilization of machines, manpower, and materials. All operations in the functional departments were put on a line basis or the nearest thing possible to it. All subassemblies and sub-subassemblies are brought after inspection to a subassembly stockroom, from which they are issued to the departments using them. A record is kept of incoming and outgoing material. This stockroom is separate from the regular one.

We worked on the premise that we wanted at least a week's supply of parts ahead of each department so that production could proceed without interruption. The controls involved are:

1. A weekly schedule for each functional department based on amounts already available to the following departments, the department's own capacity, and material available.

2. A weekly schedule for each final

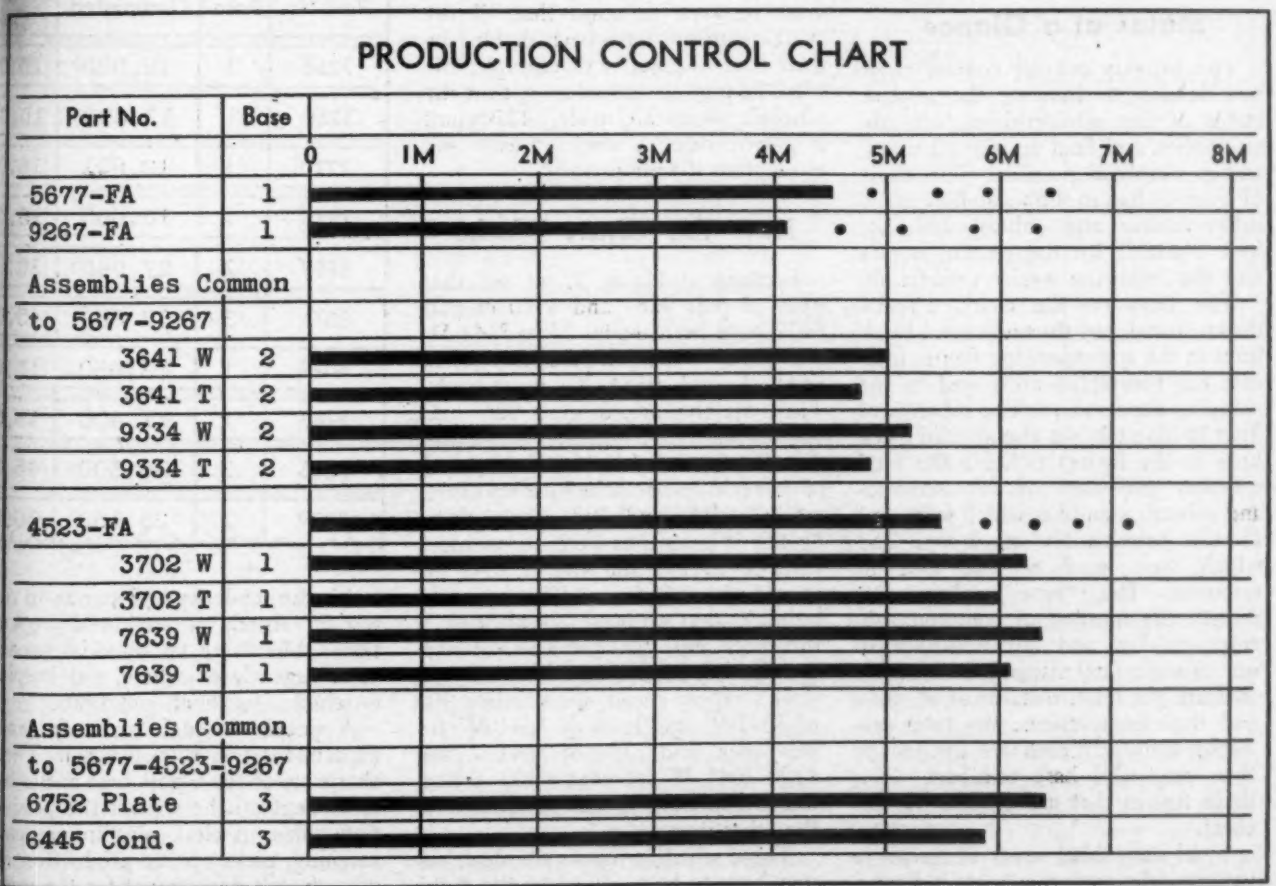

Figure 1. Actual chart is on cross-section paper, which makes it easy to fill in the bars to correct lengths. Red bars indicate final assemblies; blue mark subassemblies and sub-subassemblies. Colored pins (shown here as black dots at right of final assembly bars) show schedules for coming weeks

Figure 2. Weekly schedule sheets are written up for each production department. Progress for the week is indicated by filling in space between double lines. Output is scheduled for this week and next

Figure 3. Schedule sheet for final assembly department is like the sheets for other departments except that it has an extra column for replacements owed at the time. Circled figures are shown in red on the actual chart: they indicate number of parts actually shipped

assembly department based on its capacity, material available, and shipping requirements.

3. A record to indicate the shipping status with respect to the schedule.

4. A record to indicate the relative status of the total sub-subassemblies, subassemblies, and final assemblies produced.

It was considered desirable to have some sort of chart system that would tell the production story at a glance. The information required to compile these charts included primarily a knowledge of customer's requirements, the capacity of each department, and daily reports of actual production. Total produced figures were to be carried by the weekly schedule sheets and carried forward weekly.

Status at a Glance

The primary over-all control chart was devised to indicate the relative status of the subassemblies, sub-subassemblies, and final units at all times, and as simply as possible. This chart (Figure 1) had to show also how many subassemblies and sub-subassemblies were available for the current week's and the following week's production.

The lines on the chart, actually drawn in red, but shown as solid black lines in the accompanying figure, indicate the completed units sent to the shipping department. The subsequent lines in blue (shown also as solid black lines in the figure) indicate the total quantity produced of subassemblies and sub-subassemblies which were sent to the subassembly stockroom and which were used by the unit in question. The "base" column indicates the number of common sub-subassemblies and subassemblies in one or more final assembled units. To indicate the relative status of all units and their components, the total produced figures of each are divided by their respective base numbers. It is these figures that are plotted on this chart.

Final assembled units common to various radio equipments are indicated in the same way as their component assemblies. Colored pins are used to indicate the schedules for each week.

When we are ready to make up each department's schedule, we stick four colored pins on each finished-unit or red line. These colored pins indicate the weekly schedules desired for the next four weeks for final assembly. To find out how many of the subassemblies are needed for scheduling, based on the premise of a week's supply ahead of each department, one has only to glance at the blue lines which are below and parallel to the red line to see what has to be made in relation to the schedules as indicated by the colored pins. A subassembly for the current week should be scheduled to reach the second colored pin, and the sub-subassembly should be scheduled to reach the third colored pin, if we are to carry out our premise. When figuring the necessary components required for scheduling each week, it must be kept in mind that all the chart quantities have been divided by their base number. For example, the schedule pins are moved every time the schedule sheets are made. This chart is posted twice a week at least and more often if time permits.

How the Chart Works

Looking at Figure 1, we see that 4100 of part 9267 and 4500 of part 5677 have been made. Now 3641 W and 9334 W are sub-subassemblies to 3641 T and 9334 T, respectively. These are common to units 9267 and 5677. The chart indicates 9600 produced of 3641 T and 10,000 produced of 3641 W. The schedules on 5677 are 400, 500, and 500. From these figures, it is obvious we have on hand 1000 of 3641 T and 400 of 3641 W toward the schedules. The schedule indicates that we need 900 of 3641 T this week and 1000 the next. Hence, by the premise established of one week's supply ahead, we schedule 900 of 3641 T and 1600 of 3641 W for this week, and 1100 of 3641 T and 1100 3641 W for next week. Schedules are obtained in similar manner for the other items.

These schedule figures are ideal, but may have to be modified by the material available, the capacity of the department to produce it, and the labor situation. An important point to control is the tendency of foremen to run too far ahead on preliminary operations, thus using up material needed more urgently elsewhere, but keeping to schedule on final operations.

A weekly schedule sheet for each department was then devised. These charts are of the Gantt type and a full set is kept on the wall of the production office. A clerk goes around each morning, picks up the production figures of each department for the previous day, and posts them on the wall chart.

Each weekly schedule chart (Fig-

SCHEDUL

Part No.	Base	Completed	Total Order
2092FA	1	47,354	55,00
4639	1	43,654	55,00
4640	2	86,575	110,00
4703	1	44,825	55,00
5084H	4	176,885	220,00
5084L	1	102,176	55,00
6187	1	45,175	55,00
6189	1	44,665	55,00
6192	1	44,988	55,00

SCHEDUL

Part No.	Base	Completed	Total Order
7268	1	12,000	15,000
7269	1	12,099	15,000
7270	1	12,001	15,000
7975	1	10,000	15,000
5853	2	27,540	30,000
6076	3	37,652	45,000
6029	1	12,060	15,000
7247	1	11,400	15,000
7515	3	36,300	45,000
7239	2	25,150	30,000

FOR WEEK OF 1-10-44 — Test and Inspection Department

Total Production Last Week 11,495 — Required This Week 11,700

Schedule	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	Next Week	
0								0	
800		129	192	352	273		946	500	
1200	333	230	326	195	954		2038	600	
700		242	63	243	197		745	500	
600			500				500	600	
0							0	0	
700	239	249	269	24			781	300	
300				200			200	300	
300	61				185		246	300	

FOR WEEK OF 1-10-44 — Final Assembly Department

Total Production Last Week 10,856 — Required This Week 11,338

Total Order	Schedule	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total	Next Week	Balance of Replacements
15,000	1000	200 (200)	100 (100)		300 (300)	300	(300)	900	1000	100
15,000	901	301	(301)	100 (100)	200 (200)	200 (200)	100	901	1000	250
15,000	999		400 (400)	200	300 (500)	200		1100	1000	
15,000	2000		500 (500)	400 (400)	300	300 (300)	200 (300)	1700	2000	60
30,000	0	100	(100)					100	460	
45,000	1348	300	300 (300)	200 (500)	200	(200)	200 (200)	1200	3000	300
15,000	940								1000	
15,000	600			300 (300)		250		550	1000	50
45,000	2700	600 (600)	400	500 (900)	600 (600)	500	100 (600)	2700	1000	
30,000	850		300	100 (400)	200 (200)	100 (100)	50 (50)	750	1000	

ure 2) has thirteen columns. The final assembly chart (Figure 3) has an additional column for total replacements owed at the time. The base column indicates the number of parts required to make one complete project unit regardless of whether the part number is a sub-subassembly, a subassembly, or a final assembly. The completed column refers to total parts made to date, and the total orders column to the grand total to be made. Parts are scheduled for two weeks—the current week and the one following. On the top of the sheet the total production obtained the previous week is shown for comparison with the requirements of the current week. The narrow double lines are used for filling in the progress lines.

These schedule sheets show only the parts that left their respective departments for the subassembly and sub-subassembly stockroom or shipping department. Since the parts on the final assembly sheets are shipped out by the shipping department, and since all parts are often not shipped out the same day, some parts are held over till the following day. To have this information on hand, the shipments are posted on the weekly sheets in the same columns as the production figures, but in red. As a result, we know what is being held by the shipping department at all times.

A shipping chart (Figure 4) is also kept to show what has been shipped to companies *A* and *B*, also the grand total shipped. The chart indicates which unit part we are falling down on. It also shows which company should get the units at any given time so that its production will not suffer. Here, also, the total quantities shipped

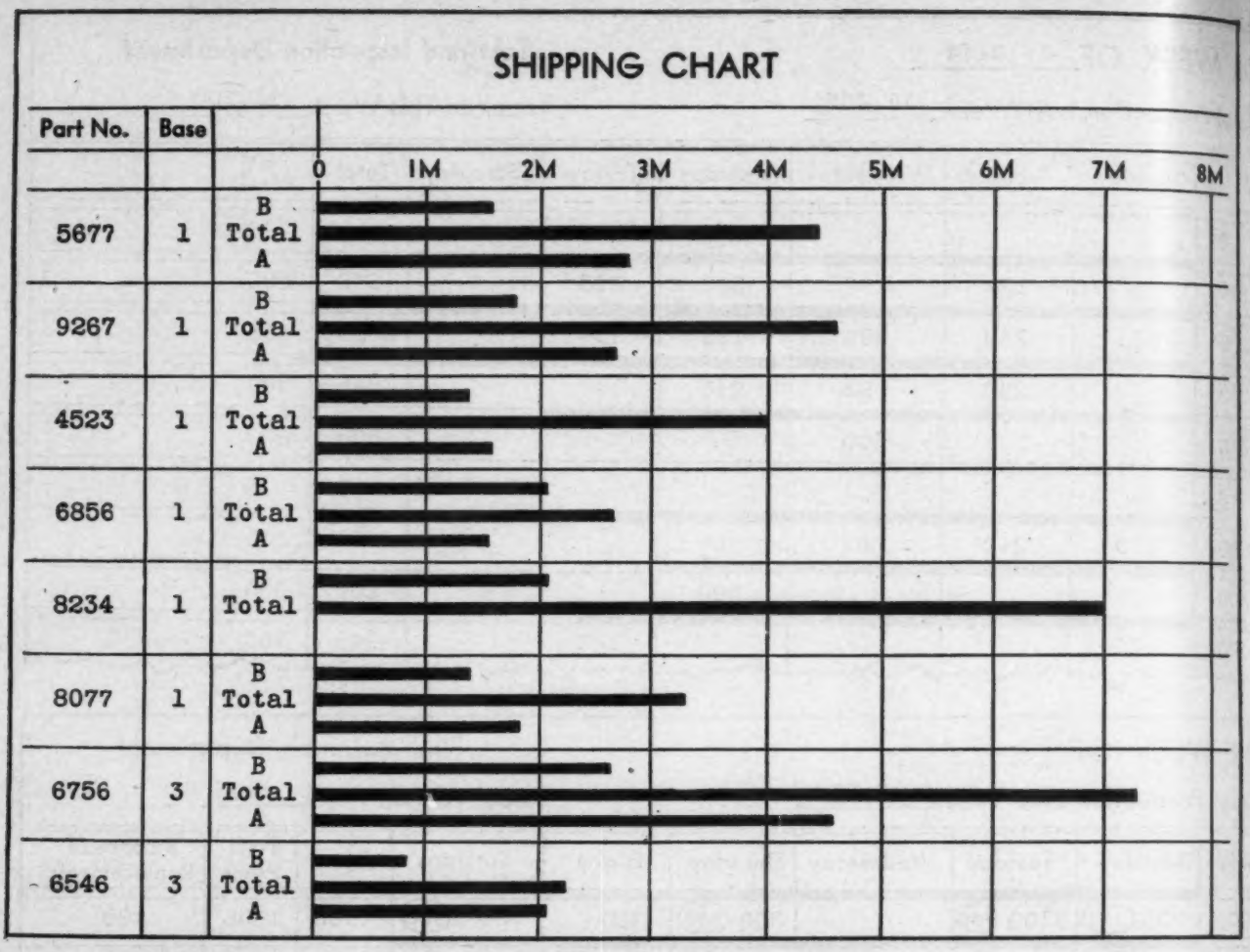

Figure 4. To show total parts shipped, also the number to companies *A* and *B*, a shipping chart of the Gantt type is kept. On actual chart the third column is omitted—and blue, green, and red bars are used, respectively, to show total parts, number shipped to company *A*, and number to company *B*

are divided by their base numbers. Colored lines are used to indicate the individual companies and the grand total. Looking at the chart, it is seen that company *B* needs more 6546 units to keep going, while company *A* needs more 8077 units. Thus both companies *A* and *B* are sure to get the units they need most.

Expediters on the Job

Production expediters, in connection with production control, are used to chase needed items from departments and to see that the more essential ones are processed ahead of others. The expediters also keep after the foremen, if they are falling behind schedules. Any difficulties are reported by the expediters or by the foremen so that steps can be taken to correct them and schedule changes made if necessary.

In this discourse, I have neglected one important feature. All final assembly departments and the central repair department have to turn in to the production control department a record of all subassemblies and sub-subassemblies rejected or scrapped. These figures are deducted weekly from the grand total for the respective assemblies on all charts. The rejects, marked with their faults, are then returned to the departments which made them. When rejects are repaired, the figures are put down as new production on the charts.

A general repair department is maintained for all units returned by the customer and for special repair work from any department. All units returned by the customer are analyzed by the departments that made them and then sent to the repair department to be repaired. The analysis indicates what should be repaired and how. When the rejects have been repaired, they go back to their respective departments for test and final inspection.

All stock material rejects, after being looked over for possible salvage, are returned to the regular stockroom to be replaced with good material. The scrap is then sent to the scrap department for disposal. All scrap records are sent to production control to be filed, and material is purchased periodically so that no shortages will occur.

The accumulation of rejects in each department is always kept as low as possible; otherwise too much material would be uselessly tied up. Production departments also would have to be pushed to keep up with the schedule, because they would have to produce more than the scheduled amounts.

Periodic Inventory

Despite all efforts, we have found that our records will not quite agree with an inventory if a project has a prolonged run. Past experience has indicated that it is advisable to take an inventory every three or six months depending on the production run of a project. It is of paramount importance that there be a definite correlation between scheduling and actual production. If there is not such correlation, production planning and control will be of little avail.

Why Women Quit

JOHN MEADE, Assistant Director, Industrial Relations, and PHYLLIS H. MOEHRLE, Technical Research Assistant, Bell Aircraft Corporation, Buffalo, N. Y.

AN ANALYSIS of the problem of female turnover is a task that has been "stumping the experts" ever since the present war enveloped American industry in a production race heretofore unequaled. To find any one answer is impossible because the causes are as varied as the number of women who quit their factory jobs.

Finding our problem was becoming particularly acute, our industrial relations research staff launched a case history study of voluntary quits among women since January 1, 1943. In an examination of 1015 cases selected at random, we have found some interesting trends. While we are aware that there is no such person, even hypothetically speaking, as a typical woman, our facts and figures have served to give us insight into some of the angles involved, and enabled us to approach a solution more intelligently. This paper covers only the first block of cases studied and evaluated. Our search for the "whys" is a continuing process.

Our initial procedure was to draw up a form showing the information we thought might be of value in analyzing our situation. We included age, marital status, dependents, education, home town, dates of hire and separation, reason for leaving, amount and kind of previous experience, employment interviewer, and department. Let us look at some of these results, bearing in mind that, while the figures stack up cumulative totals that are of interest, and give us something definite to consider in planning our "counter-attack," it is in the relation of one factor to another that we find the greatest value of our study.

Departments

In a tabulation by departments, we found that out of 1015 women who quit, 264 were in one department. It is true that numbers alone mean very little unless compared with related factors, such as size of department, percentage of male and female employment, and so forth. However, we found some smaller departments with disproportionately large losses, as well as some large departments with moderate losses. A more detailed scrutiny of this situation may reveal lack of proper supervision, inadequate provision for personal welfare, or any one of numerous other possibilities. The aircraft industry is new, and in its rapid expansion some gaps have been left by a lack of sufficiently large numbers of trained personnel to meet the present emergency, as well as the difficulty of securing proved techniques in all phases of the operations.

Age Range

In 1015 cases, we found the age range and distribution as follows:

From 18 to 20	635
30 to 40	229
40 to 50	129
Over 50	22

This spread probably follows quite closely our employment trend, because younger women comprise the group most readily available in the labor market, and requiring the least adjustment to war industry. It might also be suggested, however, that the younger women are often the ones who, once employed, are least steady and most likely to sever their connections, because of the variety of circumstances which affect them more directly than older women. In an examination of separation causes, we find young women predominate among those who quit for the following reasons:

1. Other jobs. They are more easily lured away by prospects of new and different work and surroundings. Older women do not crave novelty and are more content at routine work. This

The authors interview a girl who has decided to "quit." Properly conducted, the exit interview produces information of inestimable value

factor is now being limited through the various controls established by the War Manpower Commission.

2. Needed at home. Illness in the family, requiring the constant care of an individual, often becomes the responsibility of a younger member, particularly when there are other wage earners in the group. Situations at home, other than illness, have a similar effect.

3. Leaving town. Out of a group of 167 who left for this reason, more than 80 percent were under 30. A large number of these girls join their husbands at camp, and a minority may return to their jobs at a later date.

4. Marriage and pregnancy. This group, while small (about 5 percent) is chiefly constituted of women 18 to 30 years of age.

5. Joining armed forces. Since the WACS, WAVES, SPARS, and other groups were first organized, not a week has gone by that young women have not enlisted. Fifteen out of every thousand separations are probably of a military nature.

6. Insubordination. A study of 60 women whose services were terminated for this reason reveals that two-thirds of them were under 30. While their records were marked "Quit," and as such they were included in this survey, these people were in reality discharged for infractions of company rules.

Marital Status

Our study of this factor resulted in the following tabulation which is probably more or less typical of any 1000 cases that might be presented under current conditions:

Single	340
Married	580
Widowed	28
Separated	21
Divorced	45

While it is doubtful if we are employing more married than single women, certain conditions peculiar to the status of the married employee sometimes make continued employment impractical. Some husbands do not like their wives to work, and soon persuade them to quit their jobs if they start. In the group studied almost 10 percent left because of lack of child care facilities. Trends like these are enabling us to set up procedures which will prove of distinct value in eliminating controllable separations, and thus greatly reduce turnover.

Causes of Separation

Several reasons for quitting have already been touched upon in our discussion of the influence of the age factor (see Table I for a complete list). To these we might add the following:

1. Ill health. About 15 percent gave this as their reason for leaving. In a further breakdown within this group we found that almost 70 percent of those who quit because of ill health left within 90 days of their hire date, and a third of these women left the first week. It is not possible that ill health could develop as a result of the job during that short period, and consequently it must have been due to some condition in existence prior to their employment. We, therefore, are now checking the advisability of a more thorough pre-employment physical examination. The balance quit within a period of three months to one year. In this connection, it might be noted that provision for annual vacations should be an integral part of every industrial program which contemplates the continued efficiency of women in meeting its production quotas.

2. Work too hard. Some 67 women listed this as their reason for terminating employment. There are some who are not physically adapted to factory work, and misleading propaganda of the "glamour" type, appearing in national magazines and on the air, has served only to confuse and distort the picture. Fortunately, we feel that cases of this type are not on the upgrade, because much of the impression that women workers are "industrial debutantes" has now been dispelled, and most jobs are now taken for granted as down-to-earth operations, requiring constant energy and application, and female workers realize that winning a war is neither a picnic nor a pastime.

3. Working conditions. About 4 percent of the group left because, specifically, they could not endure the noise or constant standing. We have investigated the departments where these conditions occurred, and when we find that such complaints do not represent isolated cases, we are taking steps to eliminate the causative factors.

4. Transportation. A certain percentage of cases fall in this category, but every effort is being made to reduce this reason to a minimum. Our "share-the-ride" plan is functioning at high efficiency. An exploration of individual cases of this kind indicates that these people live at considerable distance, usually in outlying towns.

5. Dissatisfaction and unknown absence. In this group lie perhaps 15 percent of the cases analyzed. While these cover the miscellaneous cases that do not fall into any of the natural divisions, we feel that this category might well be broken down into more specific factors. If we permit foremen to merely state "Dissatisfied" on the separation slips, we are permitting a practice which eludes analysis and correction. We are now advocating the elimination of the use of this term.

As for "unknown absences," we have now set up a procedure which requires a separation slip to be processed for any individual whose absence exceeds three days, if no attempt has been made to notify the company according to our established AWOL policy. This practice eliminates carrying absentees on our books for unlimited periods, and keeps our payroll clear and our absentee records accurate. We have considered a procedure that permits the forman to defer signing the separation slip if he wishes first to have an investigation made in an attempt to retain the employee if she has been a good worker. However, we do not now include such a provision, as we found it tended to nullify the purpose of the procedure.

6. Shifts. Particularly with the second shift, we are experiencing some difficulty in maintaining our full quota of personnel, because from the worker's standpoint, this is the least desirable shift. Older women like to have their evenings free to spend with their families, and younger women want to

Table I. Reasons for and Number of Quits

Reasons	*No. of Quits*
Other jobs	63
Ill health	151
Second shift	35
Raise	7
Unknown absence	95
Needed at home	122
No one to care for children	85
Leaving town	141
Pregnant	23
Work too hard	67
Married	25
Insubordination	59
Dissatisfied	80
Joining WAC	13
Noise	16
Standing	17
Transportation	16

be free for pleasure. We have lost about 3.5 percent of our women for this reason.

7. Rates. Contrary to popular belief, a very, very small minority quit because of their rate. Out of 1000 cases, we only had 7 whose quit slip stated this was their reason for leaving. With men, this percentage would probably be much higher, because, by virtue of their experience and interest in advancement as the family wage-earner, they are more apt to be aggressive in seeking increases. Most women view their employment in a war industry as a temporary activity, from which they will, in due time, return to their homes or chosen fields.

Education

It is interesting to observe that in 1015 quit cases, the following breakdown of formal education prevails:

Did not attend high school	342
One year high school	113
Two years high school	142
Three years high school	98
Four years high school	320
including:	
1 year college	13
2 years college	15
3 years college	16
4 years college	21
	65

Previous Employment

An analysis of this factor was thought to have some bearing on the problem. In considering those who had no previous employment, again we find that 70 percent were in the 18-30 age group. Those who had experience were tabulated by number of years and type of experience as shown in Table II.

It would appear, therefore, that only 20 percent of women who quit have had any type of industrial experience, and the majority have had little or no previous training that would fit them specifically for their new duties. They have no established work habits, which might assist them in making the necessary adjustment to war work. Under such conditions they often find it difficult to rearrange their daily routine and develop work habits to permit them to handle the change in their mode of living. When this transition is not made readily, the woman often becomes discouraged, and quits.

Employment Interviews

An interesting byproduct of our study was the revelation that, in tabulating the cases, the names of certain employment interviewers occurred much more frequently than others. Interpreted in conjunction with knowledge of routines used in our employment office, we may find this information lends itself to further analysis and possible use in connection not only with more selective hiring techniques, but also with more enlightened placement of the new worker in the job for which she is best suited, by physical stamina, temperament, and experience.

It must be added that in any statistical analysis of this type, there is a certain unavoidable margin of error, which has not so much to do with the proper handling of figures, but rather with the accuracy of original information supplied. It may be easier for Mary Jones to say she is quitting because she is going to Peoria to visit her Aunt Katie, when in reality she has been continually antagonized by her foreman, but does not want to talk about it.

The fact remains that she is leaving our gates and it is our responsibility to establish techniques that will help us to determine the true cause so that we may correct it, if possible. Here is where we find the chief value of the exit interview, a procedure that we are daily attempting to perfect. We are aware that a trained interviewer can handle the final contact with an employee in such a way that not only does he leave a favorable final impression with the worker, but he also discovers wherein we have failed to do our job. This information, properly used, can be of inestimable benefit to us in improving our organization.

Why Industry Must Conserve Paper

Gas-mask canisters and hand-grenade containers are made of paper.

Huge amounts of paperboard are used by the Red Cross for blood-plasma containers.

It takes 25 tons of blueprint paper to make a battleship.

The Army supplies helmets of laminated fiber for non-combat duty in the tropics.

Paper is used to protect anti-aircraft fire control directors.

"V" boxes, made of waterproofed paperboard, used by invasion forces, are often dumped overboard and floated ashore to speed landing operations.

All Army clothing and equipment are shipped in waterproof paper wrappers.

Table II. Amount and Type of Previous Experience

Amount of Experience	*Industrial*	*Non-Industrial*	*Unknown*
Under 1 year	81	192	65
Under 2 years	31	72	30
Under 5 years	45	107	28
Under 10 years	36	76	39
Under 15 years	7	23	11
Over 15 years	4	10	2
	204	480	175

Prize Contest for Better Plant Attendance

Every Lyon Metal worker can win valuable merchandise prizes in WLB-approved contest. The plan is expected to curb the currently high absenteeism rate

A PRIZE CONTEST, in which employees receive merit certificates exchangeable for more than 500 items of merchandise, is credited by Lyon Metal Products, Inc., Aurora, Ill., with reducing its monthly absenteeism rate from 7.7 to 6.7 percent. For further proof of its efficacy, add the fact that with every pay period since its inception last September the number of employees with perfect attendance records has increased. Permission to install the program at both the Aurora and Chicago Heights plants was granted by the War Labor Board with the proviso that total amount of merchandise given to employees must not exceed 1 percent of total payroll.

Eligible to take part are all "hourly" employees in the plants below the rank of department foremen and all "monthly" employees below the rank of assistant department manager in the offices of the two plants.

Perfect Attendance

The first way to get certificates is to have a perfect attendance record for a pay period (two weeks). Each employee who makes this record receives in his pay envelope for that period a certificate worth 50 prize merits.

The second way is to win a jack pot prize. Each 50 merit certificate has a detachable stub good for one chance for additional prize merits in the jack pot prize drawing for that pay period. The holder of the certificate writes his or her name and department on this stub and drops it in one of the suggestion boxes by 10 a.m. on the day when the jack pot drawing is held, which is every Monday following a pay day.

Jack pot prizes are one of 200 merits and eight of 100 merits at the Aurora factory, one of 200 merits and four of 100 merits at the Chicago Heights factory, and one of 200 merits and three of 100 merits at the offices of the two plants. The number of prizes given out in each group is based on number of employees.

Thus the rules provide for a grand total of 18 jack pot winners on every Monday following a pay period—the second worst day of the week from an absenteeism standpoint. The element of luck is played up in the distribution of the jack pot prizes. Practically every person feels that he is "not lucky," that he has never won anything, but with 18 jack pot prizes lightning strikes in a lot of places every pay period.

Various methods are used to attract a crowd to the jack pot drawings. On one occasion a bugler and two girls walked through the factory carrying a banner telling the time and the place of the jack pot drawing. On other occasions the drawing is moved from department to department, and the employees are asked to select their

Articles that can be "bought" for prize merits are displayed—others are shown in catalog sent to each employee at the start of the plan

No. 838 F
Jack-Pot
Prize Drawing
Deposit this stub in any "Suggestion Box" by 10 A. M. on Jack-Pot Day —the Monday following issuance of this certificate. If your number is drawn, you will receive additional Prize Merits.
(See opposite side)
(TEAR OFF HERE)
Omaha Public Library
Reference Dept.
No. 838 F
LYON PRIZE CERTIFICATE
for "REGULAR FELLOWS"
For Perfect Attendance Record During One Pay Period
WORTH 50 PRIZE MERITS
Redeemable for PRIZE MERCHANDISE (See Reverse Side)

Every worker who has not been absent during the pay period finds a certificate worth 50 prize merits in his pay envelope. Coupon on the left is detached, goes into the jack pot, provides a chance of winning extra merits. Directions for redeeming the certificates are printed on the back of each

"luckiest" representative to do the drawing.

The third way to win a certificate is to have a perfect attendance record during a whole quarter. Each employee who makes this record receives two additional certificates totaling 100 prize merits.

The qualifications governing the contest are:

1. An employee may not be absent for any reason whatsoever and still participate in the prizes.

2. Absence due to any cause during one pay period will result in loss of prize merits and jack pot chances for that period only.

3. In event of certified illness or injury occurring after start of work, time lost that day will not count as absence.

4. Absence on jack pot day will result in loss of participation in drawing.

5. The contest will last indefinitely, but it is understood that Lyon has the right to withdraw the offer at any time, and that all decisions regarding the prize merit certificates shall be made by the company and that these decisions shall be final.

This program was announced on August 26 by a letter from Lyon's president, Earl D. Power, to each of the company's 1800 employees, 40 percent of whom are women:

"Did you know that there are only 103 shopping days before Christmas? With merchandise scarce these days, that's not very much time. Well, we have an idea here that will help to take some of the sting out of your Christmas shopping headaches.

"How would you like to win attractive, useful merchandise for yourself, or for gift-giving, if you like, without a bit of extra effort and at absolutely no cost to you?"

A few days after this announcement each employee received a colorful 34-page, 9x14 in. catalog, beautifully printed and displaying handsome photographs of the great variety of merchandise exchangeable for the prize merit certificates.

Message from President

On the inside front cover of the catalog is a letter from the president discussing the importance of war producers keeping up a high production rate as their contribution to the war effort and how the success of Lyon's production depends upon Lyon employees. And on the inside back cover is given complete information on every phase of the contest, even to directions for exchanging the prize merits for the merchandise listed therein, and how to use the prize merit order forms.

During the first two or three months few employees, with the exception of the jack pot winners, accumulated enough merit points to send for prizes. In the past six or eight weeks, however, there has been a big increase in the number of persons sending for gift merchandise and cashing in their certificates. The distribution of these gifts among the employees is of help to the contest because all the prizes are excellent quality and well worth owning.

Lyon does not feel that this contest is the complete answer to the problem of absenteeism. The management regards it simply as another step. It believes that new ideas must be constantly put into work in order to hold the absenteeism figure down to a reasonable percentage. It does feel that this particular plan has two outstanding advantages over anything else tried to date:

1. The promotion goes into the home. The wife and children look over the attractively illustrated prize book and become enthusiastic about some of the prizes offered. This is an extra incentive for the man to stay on the job.

2. The plan has a cumulative value. The company confidently expects the program to be more effective after it has been in operation for a number of years. By that time a large number of employees will have sent for prizes and others will have accumulated quite a backlog of merit points. Then employees will think twice before staying home for some minor reason and missing out on the merit certificate and the chance at a jack pot.

Multiplying Production by Mechanized Handling

LEWIS K. URQUHART, Managing Editor, *Factory*

Eastman Kodak applies mass production techniques to the manufacture of Navy telescopes (marked by arrows). A difficult operation has been broken down into a series of simple, repetitive jobs; output stepped up several hundred percent

WAR IS A HURRY-UP JOB—but a thorough one. So is the new technique for producing Navy telescopes at Eastman Kodak Company, Rochester, N. Y.

A specially designed roller conveyor in the Hawk-Eye Optical Works of that company has transformed a job that once took the full-time attention of an experienced instrument maker on each telescope into a large-scale production job done by inexperienced people, many of them women, and a few craftsmen. In this way the emphasis has been shifted from man to equipment, yet the product meets the same high-quality standards as before—precision standards which, if lowered by so much as a ten-thousandth of an inch, would make the instrument less effective against the enemy.

Conveyor Advantages

The conveyor system has stepped up telescope production by several hundred percent. Five models for use on dual-purpose guns, both surface and antiaircraft, are being produced by this method. Its advantages include the following:

1. It eliminates lifting—and makes possible the employment of women and of men physically unable to do heavy lifting.
2. It separates the complete operation into many simple, repetitive jobs —and permits employment of inexperienced people who can be trained for their specific jobs.
3. It affords an orderly, quick-moving process—and reveals a bottleneck in an instant.
4. It eliminates the need for complicated paper records.

All this adds up to large-scale production technique where that technique did not exist before.

It was in March, 1943, that the company assumed a large contract to increase its production of Navy telescopes. In so doing, it faced wartime's bugaboo of producing a large order in little time with a shortage of experienced help.

Under methods then in use, the tele-

Telescope is placed in cradle that will carry it over rollers on its 400-ft. trip down conveyor line

Operator (right) pulls heavy instrument from outside line across inside line to bench. Booster rollers (marked by arrows) permit easy cross-roller movement. When operator completes his job, he pushes telescope back on inside conveyor line

scope body, weighing between 100 and 200 pounds, was lifted to a flat truck, moved through the shop, lifted to a workbench. There an experienced craftsman added the necessary parts, made the necessary adjustments, performed the necessary tasks.

Because of the size of the order, the work came through so rapidly that it was impossible to keep it moving in orderly fashion.

Something had to be done, and it was. The conveyor system was designed and put into use. It consists of a series of steel-ball-bearing rollers 10 inches long, set in two 14-in. tracks, at bench level. Two assembly lines do the same work. Each consists of two roller conveyors set close together with guides on the two sides and in the center. The outside line is reserved for work ready to be done in an operation group; the inside line, for work completed in an operation group but not

Mechanized handling has eliminated lifting, made it possible to employ women on a job that formerly required skilled craftsmen—and husky ones at that. Note that outside conveyor line shows at a glance how much work is ahead of an operator; inside line, how much has been completed. A section of the conveyor is hinged so that it can be raised to let employees go in and out of the work area

Group leader pulls instrument from inside conveyor line for inspection. This technique of keeping the unfinished work on one line and the finished work on the other instantly shows up bottlenecks. A jam at one station is quickly relieved by assigning to it operators from another, not-so-busy station

inspected and therefore not ready for the next operation.

A special wooden cradle forms a base for each telescope on its journey over the rollers. As the cradle and its cargo approach a workbench, they are rolled onto it, worked on, rolled back to the conveyor, and sent on to their next stop.

To facilitate moving the cradles from the conveyor to the bench, a booster roller is set between the conveyor and the bench. To aid in moving the cradle from the unfinished to the finished run, another booster is set between the two conveyor lines.

In general, the run of the telescopes on the conveyor lines is something like this:

First assembly, where a fitting operation assures that the parts will go together properly; a preliminary optical-performance test on collimators; a tearing down of telescopes and a washing to eliminate dirt or grease accumulated to this point; complete reassembly; second optical-performance test; cleaning in an area where vacuum brushes are used by operators to remove all loose dirt and lint particles, and where the cleanliness of prism and inside lenses is checked; final performance test; another cleaning and assembly operation; Navy inspection; placement of eyepiece cap and front window cover as protection against damage; placement of the instrument in its case; Navy inspection of packaging; delivery of the finished job to the shipping room for crating.

Boosters Aids Moves

Each booster is placed at right angles to the rolls in the conveyor, but a sixteenth of an inch above them to reduce the friction between the main conveyor rolls and the cradle as it is pulled to the bench or pushed on the outside conveyor line.

Each group of workbenches forms a "station," labeled by a number and by a sign stating the name of the operation performed there—"Final Cleaning," "Mechanical Testing," "Optical Testing," "Inspection," and so on. Stops installed on the conveyor define the area for work to be done under each operation symbol. Only the group leader or keyman, after inspecting the work done in the station, has the authority to push an instrument through a movable stop.

Each group of benches has its own group leader who is equipped with a double bench containing special drawers. Each drawer holds a set of parts assembled to one instrument in the operation supervised by that group leader. Empty drawers are returned to stockroom where they are filled by stock clerks in readiness for group leaders to draw out as needed.

Tool boards on benches are used to store segment pushers, special wrenches, gear pullers, and similar tools used by all shifts. Precision tools, such as micrometers, are drawn out

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Inspector tests precision and cleanliness of telescope by "sighting" it out of window on distant "target"

and returned to the tool crib by the group leader or his alternate for each shift.

Work may be drawn from the outside line by any shift. After an operation has been finished and inspected, the following shift may do the succeeding operation.

Enough for Eight Hours

The group leader issues work to an operator, takes trays of parts from the double bench to the operator for his use, marks the serial number of the telescope on the tray. The group leader makes an effort to issue an operator enough work to keep him occupied for the ensuing eight hours.

When work is completed, the operator pushes the telescope from his bench to the inside conveyor line, returns his tray to the group leader's bench, enters his name on the tag, picks up the next telescope that has been issued to him, or, if all work issued to him has been completed, asks the group leader for more work.

The group leader inspects work done by the operator. If it is acceptable, he pushes the telescope through the removable stop to the outside conveyor line, and initials the tag.

Work unfinished by an operator at the end of a shift is left until the next day on the group leader's bench. Trays of parts belonging to these instruments are returned to the group leader's bench marked with the serial number of the telescopes. Work finished but uninspected, or work not passing inspection by the end of a shift, is marked "unfinished" on the tag, opposite the operation concerned, and left on the inside line until the next day. Each group leader inspects only the work from his own shift.

Five counterweighted jackknife lift gates, each under the control of a group leader, are installed between main sections of the conveyor. The conveyor at these points is a single outside line and is hinged to permit operators to move in and out of the area. Automatic stops are placed at each gate so that work cannot run off. When a gate swings up, it automatically locks.

At eight points, bridge-type cranes are used with automatic air hoists to lift instruments from the conveyor, and to hoist them back to the conveyor in the same manner. Hoist brakes can be adjusted to let the instruments down gradually on collimators and test blocks without damaging the surface plates of the collimators or the feet of the telescopes.

The American Process of Raising Standard of Living

Industry continually lowers production costs by more effective utilization of men and machines. Selling prices of industry's products go down. Increasing quantities of the products are sold. Dealers send larger replacement orders to manufacturers. More people get jobs making the products. More people have money to buy more products

Omaha Public Li
Reference Dep

Classroom in Pratt & Whitney Aircraft School where candidates for upgrading are trained

Upgrading—for Effective Utilization of Manpower

H. C. O'SULLIVAN, Director of Training, United Aircraft Corporation, E. Hartford, Conn.

MORE THAN A THOUSAND men and women in the Pratt & Whitney Aircraft Shops have been moved up into better jobs through a plantwide program of upgrading instituted something over a year ago. It all adds up to more intelligent utilization of manpower and, although it takes time and costs money, it is basically economical because the final result is a more flexible, better integrated, more productive organization.

For complete understanding of the problem and its solution, it is necessary to hark back to the early beginnings of our training plan. If anyone had tried to tell us several years ago that we'd soon be compelled to hang up fantastic production records, and do it with a group of farmers, salesmen, waitresses, elevator operators, golf pros, we should probably have burst right out laughing. For we all know how precise aircraft engine parts have to be; most critical tolerances are in tenths of a thousandth.

We could see early in 1940 what we were going to be up against and, by the time France fell, we knew that we were going to have to prepare ourselves to use a class of people which we had hitherto considered unemployable for our purposes.

Consequently, we set up a school in the fall of 1940 to train machine tool operators and one the following spring to train inspectors.

Due to the changeable nature of aircraft design, the engine is also constantly subject to revision and improvement, which makes it impossible for us to use high-speed special machine tools to the degree which might at first glance seem indicated. It means that we must use the more standard but slower machine tools, such as turret lathes and standard milling machines, because they can be retooled more quickly and can be used for shorter runs on miscellaneous parts. This use of standard tools also

means that our operators cannot be merely single-purpose operators who know only how to perform one or two jobs. They should be able to perform any and every basic operation upon that machine, so that when changes come through they can quickly swing into a new routine.

Of course, we have many special machines in our shop, but, by and large, the great majority of the approximately 8000 parts that go into our big 2000-hp. engines are turned out on standard machine tools.

In setting up our machine operator's school, we therefore took as our standard "unit of training" the idea that every operator trainee graduating from the school must be able to understand thoroughly and perform competently any and every standard operation upon the particular machine tool for which he or she was trained. The "know why" was considered as important as the "know how."

Indoctrination Course

In addition, while in the school for an average of five to six weeks, every trainee was put through a standard indoctrination course, which included blueprint reading, shop mathematics, small tools (including precision instruments), theory of cutting tools, shop nomenclature, and safety and company rules.

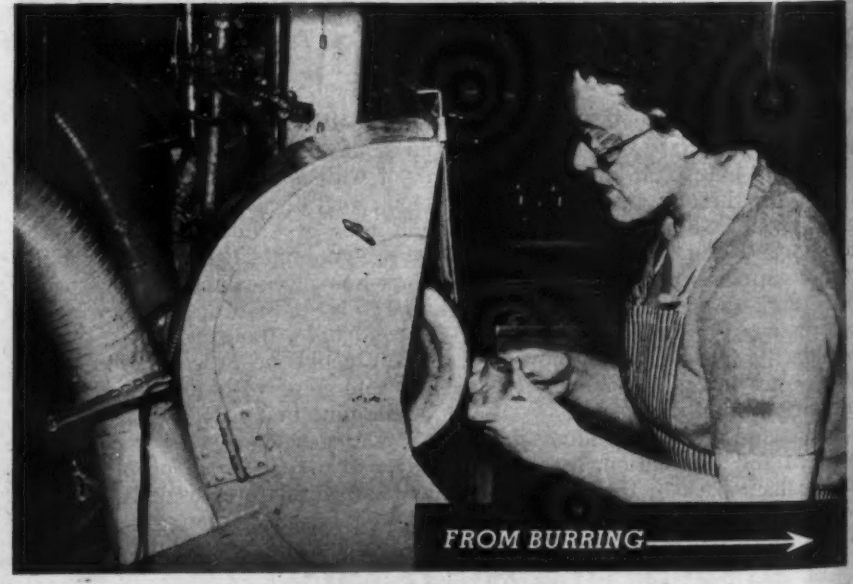
All students were being paid a base hourly rate while in school and punched in and out for an 8-hour day, 6 days a week. Of this time, 70 percent was spent at the machine under a machine instructor, and the other 30 percent in class.

When these trainees began to filter into the shop, they hung up a creditable record for themselves. They were able to do many things a supposedly "experienced" operator of the pre-war school could not do. They could really use precision instruments, and they had a basic understanding of shop math and blueprint reading which fitted them to do the job.

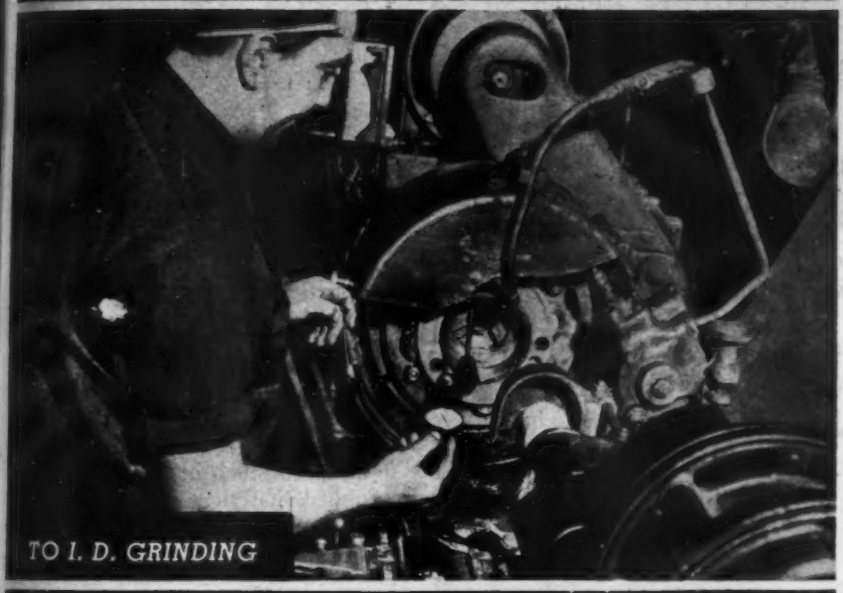
Since the school opened, we have trained many, many thousands, and our school has developed a staff of over 100 instructors, mostly former shop men who had been trained in the fundamentals of instructing.

By 1942 it was becoming considerably more difficult to get sufficient applicants for our shop training, so we determined to institute an upgrading program on a systematic basis. It was the solution to many problems. It was in line with our policy of promoting from within. It opened up to us a new source of raw material for machine tool operators, because there

★★★ HOW PLANTWIDE UPGRADING PLAN



TO MILLING MACHINE



TO I. D. GRINDING

TO AUTOMATIC LATHE

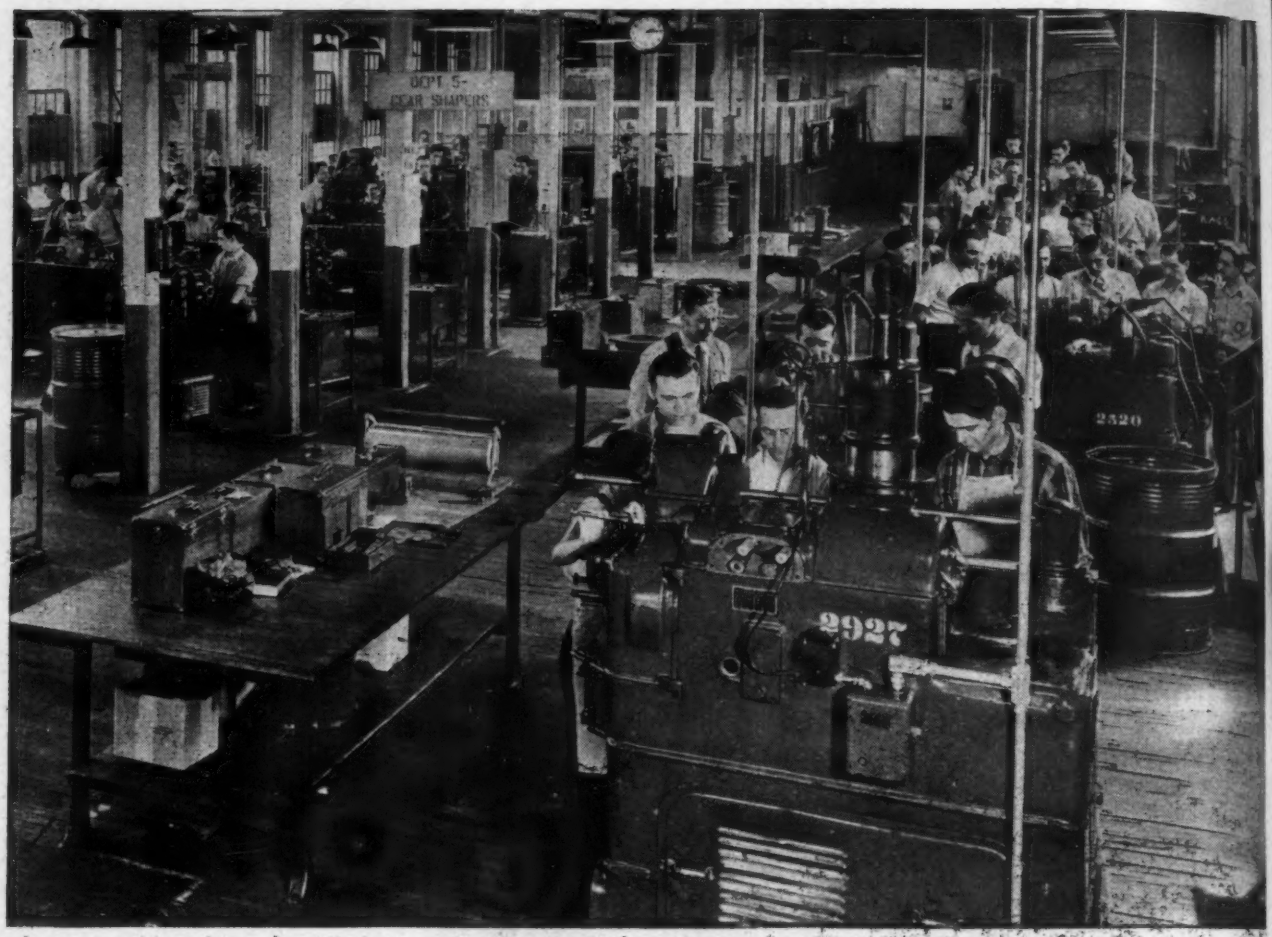
were within our plant thousands of unskilled people who had been brought in off the street and put on some repetitive or bench job, or who had been sweeping floors or trucking. Many of these people were calling for an upgrading program, either because they were at the top of the rate range for the simpler jobs, or because of a personal desire to improve their standing in the shop. The foremen, however, were not set up to give them the broad and basic training that this situation required.

It was therefore announced to the foremen through the shop superintendent's office that a definite program of upgrading was available, and each foreman was encouraged to look through his department for any unskilled individuals who might be trained into machine operators' jobs. They were specifically urged to canvass their bench help and drill press operators to see if they desired, or were willing to accept, such training. It was made clear that these people would be paid their regular base hourly rates while at the school.

The machine shop superintendent and each division superintendent systematically talked the program up to the foremen in an effort to get them to see that in the long run it would pay them in time saved if they would send this class of employee to the school for upgrading. It was pointed out that they would save time which they would otherwise have to take from supervision to do a partial training job, and that they could expect these employees to be more competent and hence require less supervision once they were properly trained.

Comprehensive Program

Basically the training for this upgrading program is the same as that developed for training of machine tool operators who, it was assumed, had had no previous shop experience. Here again we must stress the point that the "know why" is just as important as the "know how" in order to perform the functions of a machine tool operator in the Pratt & Whitney Aircraft Division, since there is no assurance that the job of today is the job of tomorrow—in fact, you can count upon this not being so. Unless the operator is so trained basically that he can meet these changed conditions, either we should completely fail to meet our commitments or be compelled to lower our targets, since we should have to take into consideration the necessity for retraining the operators each and every time we are faced with changed manufacturing proce-



One of three wings in machine school where workers recommended by foremen for upgrading spend about 70 percent of their time developing skill in basic operations on particular machines

dures brought about by changes in engineering design.

Bear constantly in mind that the product of this training is not a machinist in the old sense of the word. He is a capable machine tool operator who is trained to use production gages and fixtures. He is competent to make any average production set-up on the machine tool for which he is trained. He can, immediately upon induction into the production line, get out his production quota no matter what variety of parts of what different types of materials may be involved. He has been taught to get out of the machine tool the effective qualities that have been built into it by the designer and manufacturer. He can compute his own feeds and speeds. He has a basic understanding of the use of cutting fluids and cutting tools and appreciation and respect for the machine tool upon which he is working. Furthermore, he has developed a pride in craftsmanship and respect for the work he is doing, the tool he operates, and his fellow-worker.

The program has been extremely satisfactory. As already stated, more than a thousand shop men and women have been upgraded. The foremen are better sold on the idea than they were at first, because they were averse to breaking their men away from the department for five weeks in the press of today's production. But the men came back to their foremen so much better qualified and refreshed that they more than repaid the foremen for the time at school.

The principle of upgrading, which has been so systematically applied in the production department, is by no means confined to the development of machine tool operators. It is definitely the policy of this company to upgrade through the organization, and the policy is carried out by special training courses developed to meet various special requirements.

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How an Industry Solved Its Wage Problems

Wage survey has been accepted by management, labor, and War Labor Board as factual basis for handling problem presented by radio industry, Chicago area

A SURVEY OF WAGE RATES made in the Chicago area provides a pattern for similar studies that will enable other industry groups to study and solve their wage problems.

The survey was made by Benge Associates of Chicago for a group of 41 radio companies beset with manpower troubles, chief among them being inability to compete on equal terms with companies in the same area with higher wage scales.

Purpose of the survey was to compare rates of the radio and non-radio industries, and to use the findings in a joint petition to the National War Labor Board for permission to make the adjustments necessary. The survey covered 41 radio and 24 non-radio companies.

Procedure was briefly as follows: A job selection committee agreed upon 30 basic job titles. In 7 of the 30, male and female employees were found to be doing different kinds of work, so in reality 37 jobs were covered. Job descriptions were written for each of the 30 basic jobs.

Finding the Facts

A data sheet (Figure 1) was then prepared, with space for the name of the contributing company, total number of employees, code number assigned by Benge Associates, title of job, number of employees on job, survey number, starting rates, minimum and maximum rates. Also ascertained were number of employees in each step of a grade, hours worked per week, average hourly earnings (weighted average) for each job, and certain other data as shown.

When all the information sought from both the radio and non-radio companies was obtained, the data were compiled in exhibits showing (1) a summary of 41 radio company rates, (2) a summary of 24 non-radio company rates, (3) totals and averages for the 41 radio companies, (4) totals and averages of the rates for the 24 non-radio companies.

Another exhibit compared non-radio companies and radio companies as to the highest maximum rates, the lowest minimum rates, and the weighted averages. For example, it was found that, for the job of analyzer, the non-radio companies were paying 1½ cents above radio maximum, 23 cents above radio minimum, and that the non-radio average was 10 cents above radio average.

Still other exhibits were made to show turnover and other data. A "scatter diagram" was used, for example, to compare radio and non-radio rates. Each dot on the diagram represented one of the 37 jobs and was plotted on the chart from the job averages shown in the accompanying table. Thus the lowest dot on the scatter diagram represented the job of female riveter, averaging 64 cents in radio companies and 61 cents in non-radio companies. The highest dot represented the job of tool and die maker, averaging $1.41 in radio companies and $1.44 in non-radio companies.

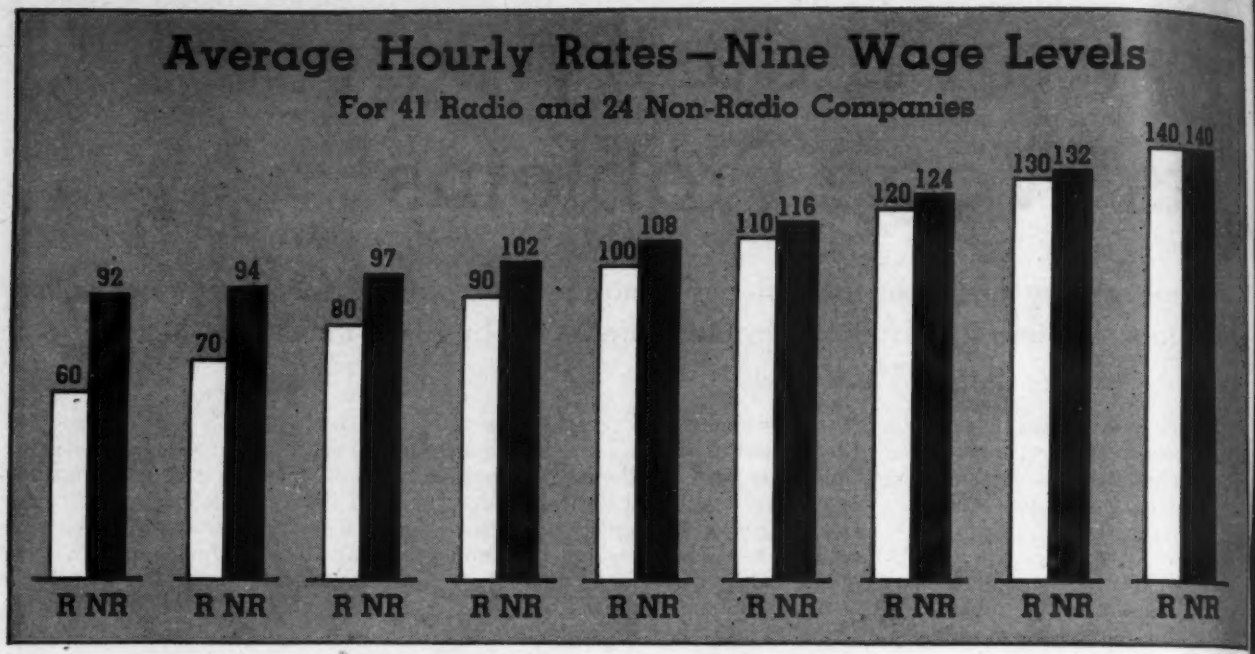
Bar charts were then constructed to show (1) comparison of average rates of radio and non-radio companies; (2) average hourly rates being paid at nine wage levels, radio and non-radio (Figure 2); (3) labor turnover, radio and

Benge Survey
for Chicago District Radio Industry

Company ..... Total company employees ..... Code ....
Job title ..... Employees on job ..... CDRIC No. ....
Starting rate ..... Minimum rate ..... Maximum rate .....
No. Employees ..... Rate ..... Per hour .....
No. Employees ..... Rate ..... Per hour .....

Hours worked per week ..... Average hourly earnings .....
Profit sharing or bonus — amount $ ..... How often? .....
Pensions .....
Other compensation .....
Vacation .....
Newly hired ..... August ..... July ..... June .....
Exits from payroll ..... August ..... July ..... June .....
Reasons .....
Number workers needed to meet schedule next six months .....
Dollar value of production based on schedule .....
Date ..... Signed:
.....

Figure 1. Data sheet was used to secure necessary information from the 41 radio and 24 non-radio companies covered in the survey



Comparison of Radio and Non-Radio Wage Rates (Weighted Averages)

Job		Radio	Non-Radio
Analyzer	M	98	108
Chassis Line Inspection	M	81½	102
Chassis Repairs	M	83	89½
Coil Assemblers	F	61½	91
Coil Inspectors	F	63½	75½
Coil Winders	F	70	89½
Die Setter	M	101½	134
Drill Press Operator	M	75½	91
Drill Press Operator	F	68½	61½
Final Test (Installation Inspection)	M	88	84½
General Maintenance	M	98	123
Incoming Inspection	F	61½	94½
Electrical	M	73	94
Electrical	F	64½	75
Mechanical	M	71	97½
Mechanical	F	60	88
Precision	M	98	110½
Precision	F	67	97
Line Part Changers (Repair Girls)	F	67	96½
Line and Subassembly (Soldering)	F	63	86½
Line and Subassembly (Wiring-Lacing)	F	60	93
Packer	M	74½	78
Punch Press Operator	M	78	82½
Punch Press Operator	F	72½	64½
Receiving Clerk	M	67	74½
Riveter	M	65½	86
Riveter	F	64	61
Single Spindle Drill Press Operator	M	71	90
Single Spindle Drill Press Operator	F	69½	75
Skilled Maintenance	M	110	112½
Spot Welder	M	80½	69
Stock Delivery	M	68	88
Stockkeepers	M	71½	91
Subassembly (Kick Press Operator)	F	58½	94½
Tester (Phasing)	M	93	113½
Tool and Die Maker	M	141	144
Trucker	M	68	73

Figure 2. A comparison of hourly rates at nine wage levels shows consistently lower rates in the radio companies

Table shows average wage rates for 37 basic operations

non-radio, showing quits, hires, and net gain.

A summary of findings follows:

1. Radio rates averaged about 30 cents per hour less than non-radio.

2. The discrepancy was greatest in lower wage levels, decreasing with higher levels.

3. Labor turnover (exits) in radio companies was running around 134 percent per year; in non-radio companies at 110 percent per year.

4. Exits from June to August increased by 56 percent in radio companies, by 35 percent in non-radio companies.

5. New hires from June to August increased by 36 percent in radio companies, as against 2 percent in non-radio companies.

6. New hires exceeded exits, June to August, by 1990 employees in radio companies, and 5571 employees in non-radio companies.

7. Radio industry as of October 1, 1943, estimated that it needed 9422 additional employees to meet its present production schedules.

8. Dollar volume of orders on hand for completion within next six months by radio companies was estimated at 300 million.

How to Develop Formulas for Standard Times

E. A. CYROL, McKinsey, Kearney & Company, Chicago

ALTHOUGH PRODUCTION STANDARDS have been successfully set up in widely varying plant operations through the use of formulas, the process of establishing time standards for individual operations without benefit of separate time studies has been utilized all too sparingly in the past. Today, with increased need for standards and with a minimum of time study manpower available, the possibilities that lie in this useful tool of management are not to be overlooked.

Production standards determined by means of correctly developed formulas are not just estimates or so-called "educated guesses," but precise production rates. It usually happens that a time study analyst, while tabulating data for a formula, becomes thoroughly convinced that production standards coming from this formula are more accurate and trustworthy than rates based upon separate time studies. Whereas a production rate from the data of a formula is based on a number of averages, a production rate set up on the strength of one time study is based on a single set of figures.

Useful for Short Runs

Furthermore, an individual time study can be used only to a limited extent in estimating, whereas the formula gives an actual production standard for estimating purposes. And its use does not end here. It can be used in small job shop operations where the accurate time study is very nearly impracticable. For example, when an order comes in for 1, 2, 3, 10, or a 100 pieces of a special design that will never be re-ordered, a study cannot be made quickly enough to be put into effect before the order is through the shop, never to come back again. On the other hand, a formula developed upon similar study can be utilized to prepare the production standard before the job is accepted in the plant.

Formulas can be easily tailored to suit the needs of your plant from time studies taken within it. Little more time is needed for this activity than to calculate production-standards time studies. In fact, two birds can be killed with one stone, if it is carefully aimed.

The nice part of introducing formulas into the time study picture is that it can be done "on trial," so to speak, with the expenditure of a small amount of time study manpower.

As the initial step in this direction, a time study man with a reasonable amount of experience and a fairly good background in mathematics might be assigned to develop a formula for a single, preferably simple, operation in the plant, with which he is acquainted.

If a reasonably careful choice is made in selecting a simple operation of few elements, a formula can be developed and tested in a few hours of uninterrupted work or in a few days of working at it "in between." After management is convinced that formulas are practicable, a full-scale program can be designed and adopted. The plan discussed here is based on similar elements in similar operations.

After an operation has been selected as a proving ground and a time study analyst assigned to make the test, all studies thus far taken on this operation are analyzed. For this analysis, a work sheet like the form illustrated in Figure 1 is found useful. Although the form need not be followed, the information indicated is necessary. If the formula is to be tested where no standards have been set before, the time studies are taken and the work sheets are developed simultaneously.

Basically, the purpose of the work sheet is to compare the elapsed times for identical studies taken—for example, on all drilling (machine shop); square shearing (sheet metal shop); blanking, drawing, or forming (punch press department); crating (shipping dock). Time studies, to be useful for formula construction work, must fit into the same general "frame"—i.e., in general, all drilling operations are composed of such elements as:

1. Pick up piece; place in jig and clamp. (The study must indicate kind of clamp, "quick acting," wingnut.)

2. Drill. (The study must show size of hole, length of hole, tolerances, type of drill used, feed.)

3. Remove piece and place aside.

A complete drilling operation study should carry such additional information as kind of material used, drill press, r.p.m. of machine, coolant used, and a sketch of the general layout.

Admittedly all the time studies on drilling within a plant will not fall into this same general "frame," but then one formula cannot possibly cover all drilling operations. One formula may serve to determine the standards of all drillings of a single hole in a small piece. A variation of it may be used for small pieces with more than one hole; another for large pieces which cannot be lifted easily into the jig, with some mechanical handling necessary, and so on.

For purposes of illustration, let us develop a formula for square-shearing sheet metal. As a general rule, shearing operations are comprised of a series of elements along these lines:

1. Position to gage and trip shear.

2. Reposition and make additional cuts.

3. Push last piece through shear.

Our studies also carry information which indicates that the metal sheared is a certain gage, hot or cold rolled, what the general work center layout is, and a sketch showing pattern of cuts.

With a stack of recorded square shear time studies, or as the studies come in off the shop floor to be cal-

The American Way

The lower the production cost of industry's products, the lower the selling prices can be. Low selling prices stimulate widespread purchasing, which calls for large manufacturing orders, which provide extensive employment.

WORK SHEET

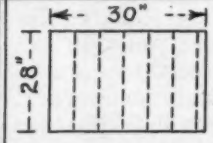
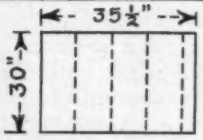
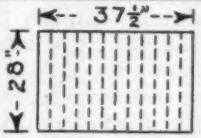
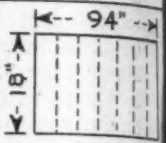
TIME STUDY NUMBER		1	2	3	4
KIND OF MATERIAL		1/3/43	1/15/43	1/20/43	1/18/43
DATE OF STUDY		C.R.	C.R.	C.R.	H.R.
MACH. NO.—DEPT. NO.		B-15-12	B-14-12	B-3-12	B-1-12
OPERATOR NO., NAME		1215-Mann	1217-Smith	1215-Mann	1213-Arno
SKETCH—Pattern of Cut					
1	Position sheet to gage and trip shear	.0825	.1100	.1050	.1755
2	Reposition and make additional cuts				
	Time values shown-minutes per cut	.0249	.0299		.0435
3	Push last piece through shear	.0300	.0300	.0235	.0240
2A	Reposition and make additional cuts "on the jump"			.0224	
2B	Reposition (Turn 90°) and make additional cuts				

Figure 1. Work sheet is used for analysis of time studies preparatory to working up a formula. In the case described in the text, a formula is developed for certain square-shearing operations

culated, we can begin entering the data upon the work sheet.

Study No. 1. The gage of the metal is given, the type of the metal noted, a sketch of the pattern of cut is made, and the time values of the elements are recorded as illustrated in Figure 1. The pattern of the cut, of course, need not be to scale but only to indicate how the sheet was cut.

Study No. 3. This study is similar to the others, but it is the first one of the group in which the cuts occurred "on the jump" and so the "per cut" time value is entered separately. In other words, in this case the strips were narrow enough to allow for repositioning during the revolution of the machine, so the entire sheet was cut up into strips without stopping the machine.

Study No. 7. The time "per cut" has within it the time required for a 90-deg. turn to reposition the sheet after the first squaring cut, and so this value is written separately. Otherwise the study is like the others.

With the time values conveniently recorded, the analysis begins. The goal is to find the one characteristic of the material, sheet steel in this case, which has a logical connection with the time values for each element. Offhand, it might be reasoned that time for "position sheet to gage and trip shear" should logically vary in direct ratio to the size of the sheet. "Reposition and make additional cuts" would certainly be closely tied up with the width of the sheet or the machine time if the machine were run "on the jump." "Push last piece through shear" from all appearances should be constant.

The most practical way to find this characteristic property which has the desired relation with the elemental time value is to utilize the graphic method.

In Figure 2, the first elemental time value is graphed against the areas of the sheets sheared. The sizes were given in the time study write-up. Using the vertical axis for the time value and the horizontal axis for area of sheet in square inches, the values are plotted. Each point is marked with its time study number in order to identify it with the source on the work sheet.

After we have placed all the points available on the graph, we attempt to draw a straight line or regular curve through them to give us the trend or ratio. From the graph it would seem that we have made a wrong guess, because a smooth curve cannot be drawn through the points given. As a matter of fact, we *have* made a wrong guess for this particular group of time studies, but all is not lost. There are other size values that can be tried in this same manner. The length may be the key characteristic. Plotted against time, it certainly seems to have a definite ratio, except for the straggler point from time study No. 6. Investigation

FORMULA: Square Shearing - Dept. 12

5	6	7	8	9	10
1/30/43	2/15/43	2/15/43	3/4/43	3/6/43	4/5/43
G.R.	Vit Iron	G.R.	H.R.	G.R.	H.R.
B-15-12	B-6-12	B-15-12	B-14-12	B-1-12	B-1-12
1-Smith	1213-Arno	1213-Arno	1215-Mann	1215-Mann	1217-Smith
← 100" →	← 64" → 30"	← 50" → 40"	← 33" → 28"	← 24" → 18"	← 87½" → 20"
.1800	.2405	.1204	.0903	.0876	.1465
.0309	.0357				.0373
.0298	.0289	.0163	.0301	.0246	.0248
			.0239	.0269	
		.0623			

explains the reason for its nonconformity; it is 10 gage whereas all the other studies are within the 16 to 20 gage span. The value is therefore circled out, and the study set aside until a new formula is in process of formulation for the heavier gage metal. This is in line with our decision at the outset to limit the formula's use to its rightful domain.

Satisfied that we have the first element correctly graphed in Figure 3, we may proceed to the next element, "reposition and make additional cuts." This time value was calculated to "minutes per cut" before it was recorded on the work sheet so that all such values would be based on a common denominator. In Study No. 1, for example, the time value was 0.1492 for the second element. This, divided by the number of cuts made (6), gives us the value "per cut" of 0.0249 minute which is recorded on the work sheet. Here we reason that the time per cut should vary as the width of the strip cut. Indeed, the time values when plotted clearly indicate their affinity for these properties. When the strips are narrow, the sheet can be repositioned during a revolution of the machine and the time per cut is actually the machine time. The wider strips require longer repositioning time, as is borne out by the graph.

The third element of the square-shearing operation is plotted as the others, and its expected consistency is proved. It may henceforth be treated as a constant.

Stating the Formula

Actually, the work of constructing the formula is finished. It is necessary only to determine the form it should take. There are three methods that may be utilized. The formula may be stated in one of the three following ways:

1. A mathematical statement; this requires the curves to be expressed as algebraic equations.

2. In table form; giving time values by increments of size, weight, volume, or any other characteristic of the part that is being studied and using only a single grouping formula.

3. The curves themselves with no embellishment.

Although the first method has the advantage of being compact, it should be used only if the time standards are to be calculated by the estimating department personnel or others who can be expected to manipulate fairly complicated mathematical equations.

In the table form, the user need not be adept at handling mathematical equations, and so this method should be utilized if the tables are to be used by time study clerical help who know the operations but are rather limited as far as the matter of solving equations is concerned.

If the plant operation is comparatively small and one department performs the functions of estimating, establishing of standards, and making time study observations, curves can be utilized without further ado.

As a mathematical statement, the formula may be expressed when cuts are made "on the jump":

$0.00125L + 0.025N + 0.080 =$ minutes/sheet sheared.

CONTINUED ON NEXT PAGE

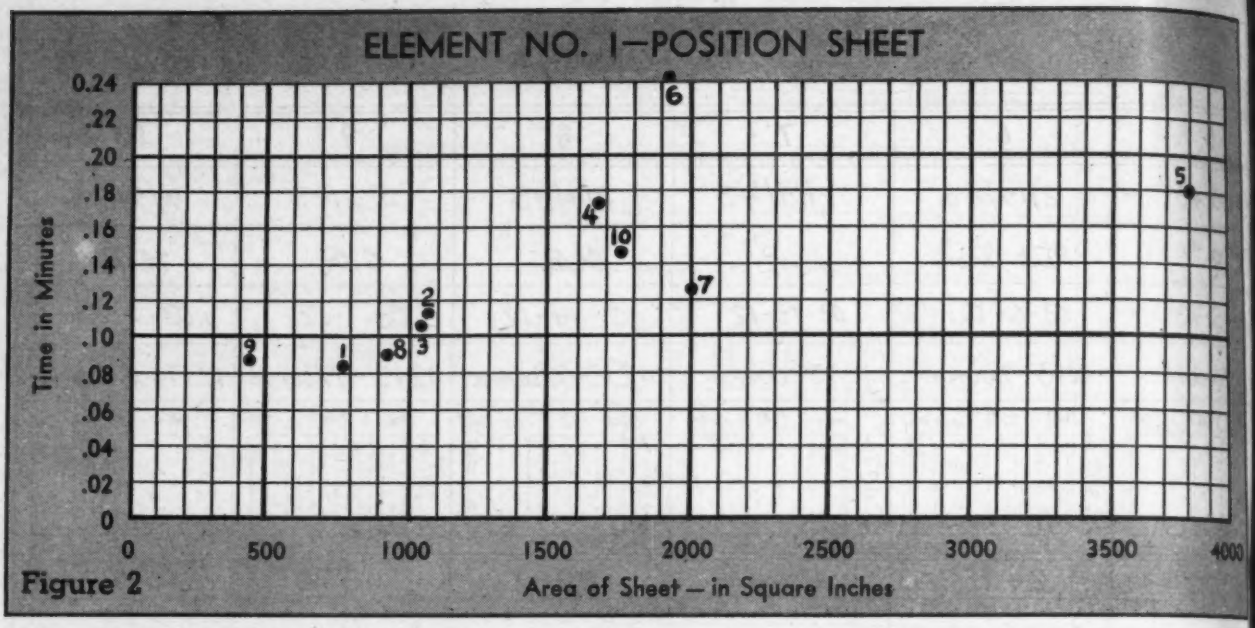


Figure 2

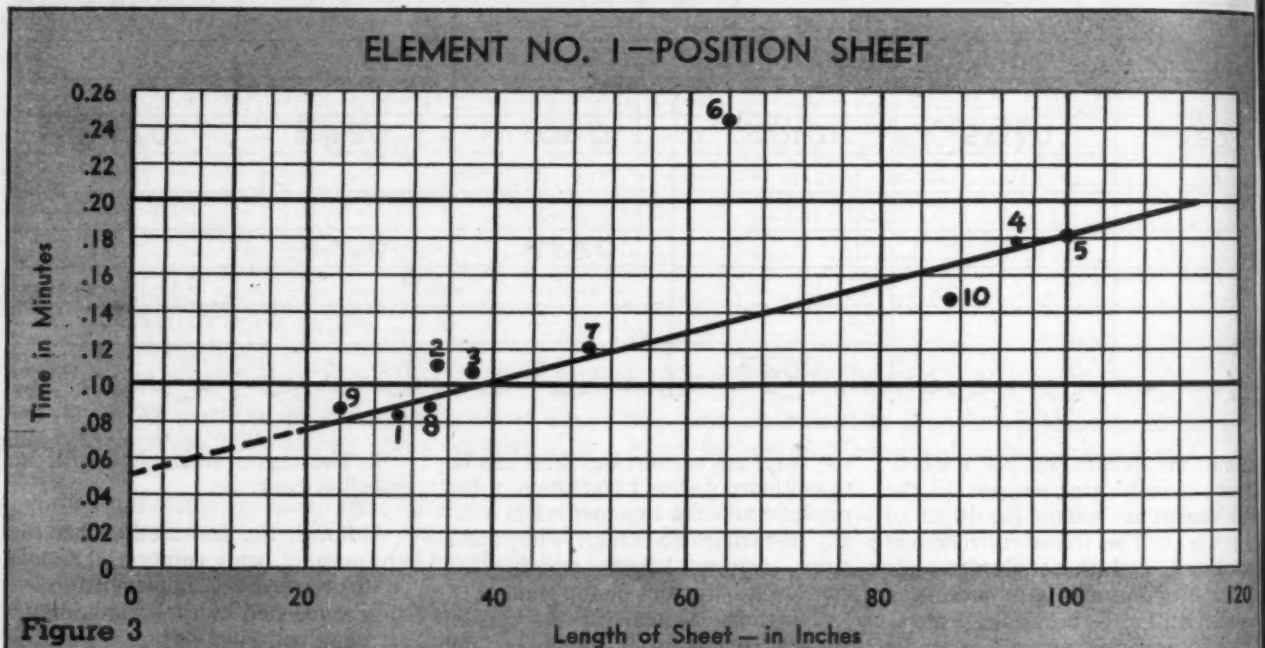


Figure 3

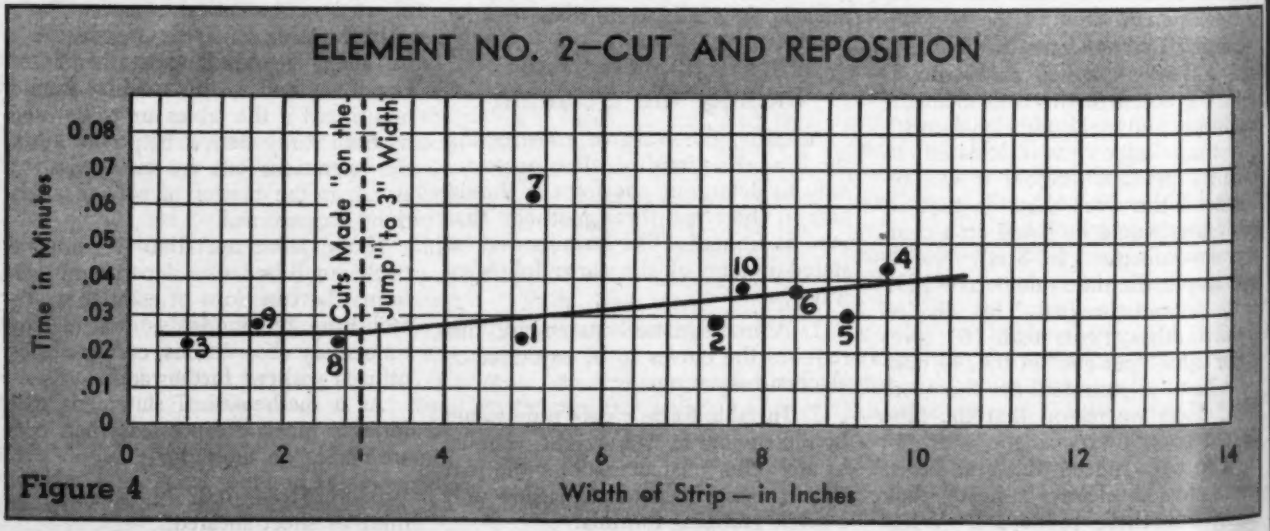


Figure 4

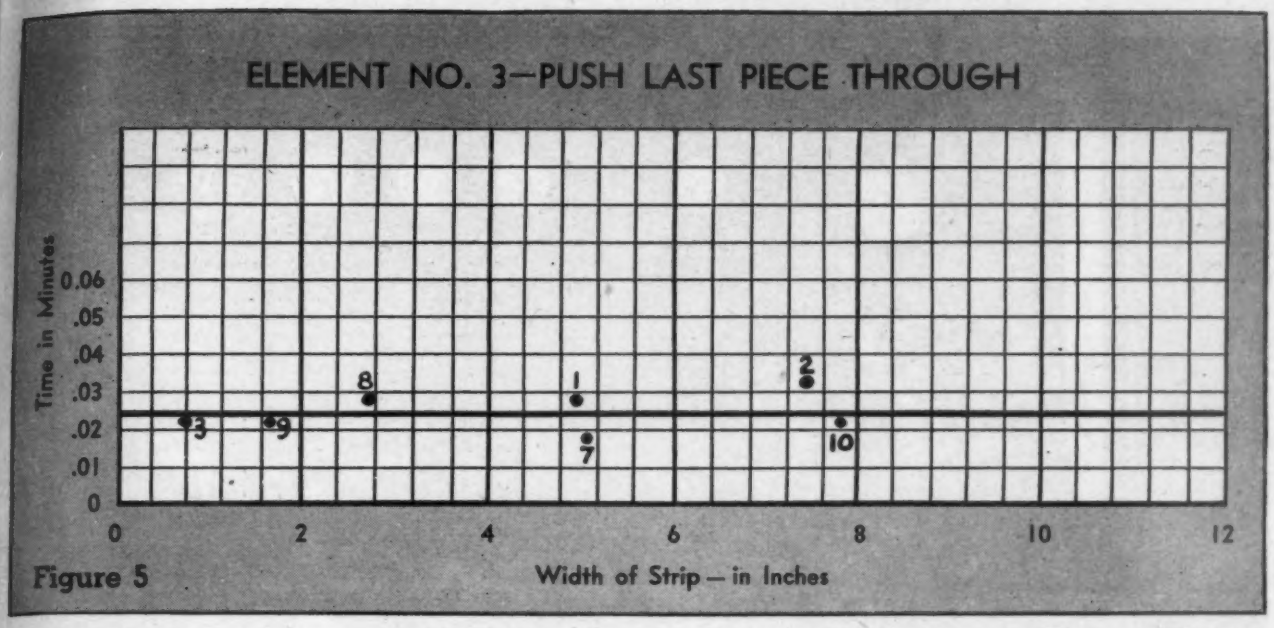


Figure 5

Table I—Elemental Time—Position Sheet Steel to Square Shear

Length (inches)	Time (minutes)	Length (inches)	Time (minutes)	Length (inches)	Time (minutes)	Length (inches)	Time (minutes)
20	0.0800	40	0.1050	60	0.1300	80	0.1550
22	0.0825	42	0.1075	62	0.1325	82	0.1575
24	0.0850	44	0.1100	64	0.1350	84	0.1600
26	0.0875	46	0.1125	66	0.1375	86	0.1625
28	0.0900	48	0.1150	68	0.1400	88	0.1650
30	0.0925	50	0.1175	70	0.1425	90	0.1675
32	0.0950	52	0.1200	72	0.1450	92	0.1700
34	0.0975	54	0.1225	74	0.1475	94	0.1725
36	0.1000	56	0.1250	76	0.1500	96	0.1750
38	0.1025	58	0.1275	78	0.1525	98	0.1775
						100	0.1800

Table II—Elemental Time—Reposition and Make Additional Cuts

Width (inches)	Time per Cut (minutes)
0.5 to 3.0	0.0250
4.0	0.0271
5.0	0.0293
6.0	0.0314
7.0	0.0336
8.0	0.0357
9.0	0.0378
10.0	0.0400

When cuts are made not "on the jump":

$0.00125L + (0.0195 + 0.002W)N + 0.080 =$ minutes/sheet sheared.[1]

Where:

L = length of sheet in inches
W = width of strip in inches
N = number of cuts per sheet

Table I and Table II show the same information in table form. In this case, the formula to give the production standard is simply:

Table I+N (Table II) + 0.0250 = minutes/sheet sheared.

The curves are available for use to calculate time study and time standards directly.

Together with each formula developed an example should be given to illustrate how this formula is utilized and what information as to material size, specifications, etc., is required.

For the square-shearing formula just developed, the following example would serve the purpose.

Example: Find the production standard for square-shearing Part No. 675732, reinforcing bracket.

From steel specifications it is learned that the sheet steel will be purchased in 55½x32-in. sheets, 16-gage cold-rolled steel, which will be cut to 5½x 32-in. strips.

Using the formula the following computation is obtained:

$0.00125L + (0.0195 + 0.002W)N + 0.0800 =$

$0.00125\,(55.5) + (0.0195 + .002\,[5.5])9 + 0.0800 =$

$0.694 + 0.2740 + 0.0800 =$

$0.4234 =$ minutes/sheet sheared.

Using the tables (shown directly above):

Table I + N(Table II) + 0.0250 =

$0.1243 + 9\,(0.0303) + 0.0250 =$

$0.1243 + 0.2727 + 0.0250 =$

$0.4220 =$ minutes/sheet sheared.

Using the curves only:

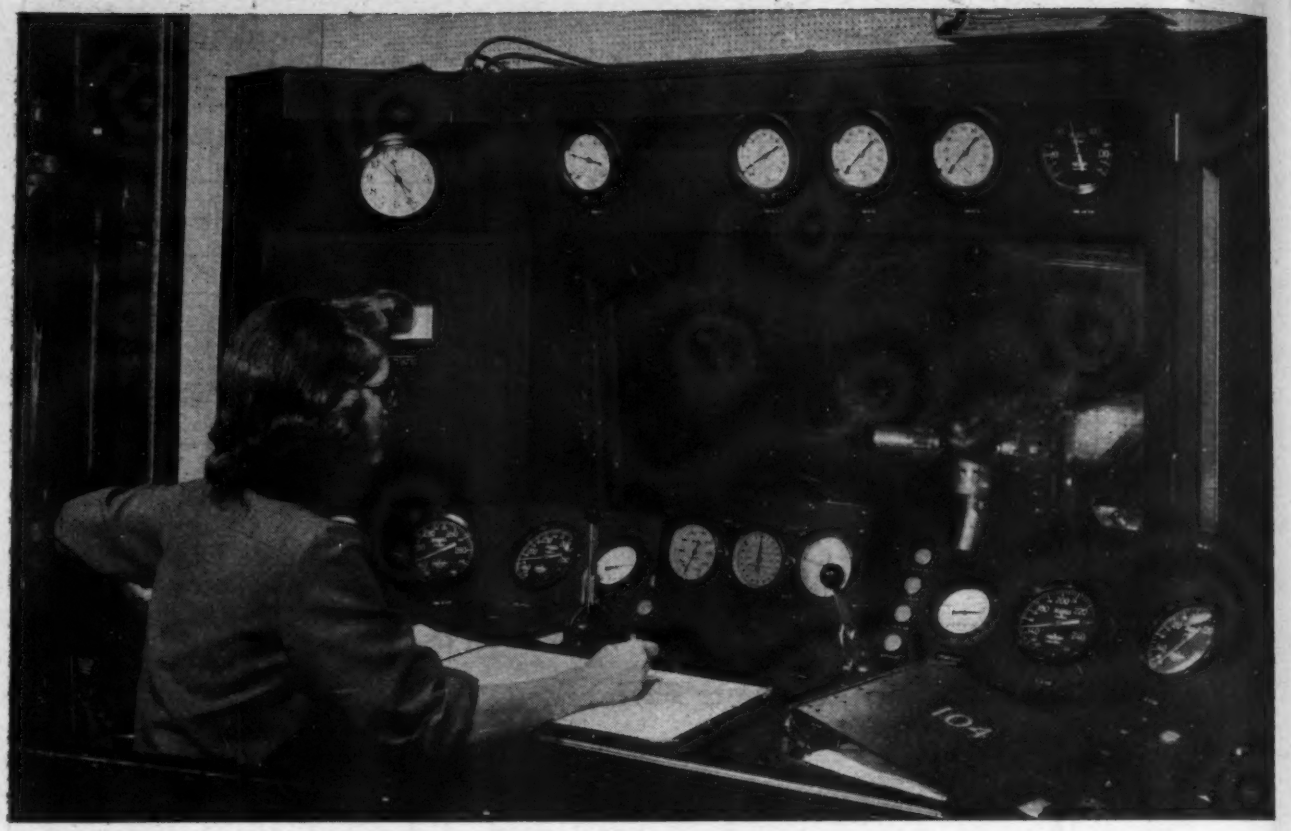
$0.1250 + 0.0300 \times 9 + 0.0250 =$

$0.1250 + 0.2700 + 0.0250 =$

$0.4200 =$ minutes/sheet sheared.

Of course, the time given by the formula does not contain any allowances. Before the formula is put to use, the allowance figure normally used in the department should be carefully examined. It must contain all allowances necessary for unavoidable delay, personal, and fatigue requirements which must be added to the actual operating time given by the formula. When the percentage allowance is ascertained, it is added to all time given by the formula to give the actual production standards for the shop.

[1] For a straight line: $y = a + bx$
from the "position" graph, Figure 3,
$y = 0.055 + 0.00125x$
x = L = length of sheet in inches
y = minutes for "positioning sheet"
Same procedure is followed for each curve. Summation gives complete formula.



On and about the test control panel in front of the operator there are 79 instruments to be carefully watched. There are no allowances for guesswork. Properly trained, women make good test operators

Training Women to Test Aircraft Engines

W. G. GUTHRIE, Works Manager, Allison Division, General Motors Corporation, Indianapolis

CAN WOMEN STAND THE GAFF of being aircraft engine production test operators? Allison's attitude was that no one could answer that question until women had been adequately trained and tried.

Engine test operation at Allison had always been considered a field for young men, particularly those with technical training, mechanical ability, and an intense interest in this type of work. Our problem, which isn't news to any of us, is that the larger portion of these men have been taken into the armed forces, and those who are left are rapidly being absorbed. Thus it became necessary to consider replacements from some other type of labor source. The fast reaction time and concentrated attention required in engine test operation made it difficult to find men above draft age who could maintain the pace. In reviewing other possibilities, the performance of the women in our shop led us to believe that they might be our source.

There were some who were skeptical of our being able to put women on this job. They were not against the idea of women working on production jobs, but rather were dubious because of the technical and mechanical background that they felt was necessary.

Today our program of training women, after having gone through its process of refinement, is giving results above our expectations. This program, worked out by our training director and test operations management, was briefly a study of the job from the standpoint of setting up a training schedule, establishing the qualifications for selection of women trainees, and the actual training schedule.

Of the women who have completed the training course, sixteen are working in the regular production testing of Allison engines. There is no particular point in drawing any direct comparison between men and women on this job, although we can say that the comprehensive training program given to the women was not available to men. There are several points that are particularly commendable in the women working on this job:

1. They are meticulous and careful in performing their work.

2. They adapt themselves quickly.

3. They follow the rigid engine testing specifications to the letter.

4. When they notice any irregularity during the testing operations they are quick to call it to the attention of an expert before going ahead.

Against these good points there are a few drawbacks, although they are not serious. Women are apparently a little reluctant to get their hands dirty. This is possibly a problem of individualities rather than a characteristic of the entire group. They are somewhat lacking in a practical background in mechanics, which is apparent only when we compare them with men who, because of their mechanical experiences, are able to find occasional short cuts in their work, or who can foresee the results of some mechanical deviation. Women who show the slightest tendency towards nervousness are not likely to become good operators. We have had some men who, although nervous, were able to overcome it, but nervous women apparently go to pieces under stress.

Thoroughly Tested

The Allison engine is a compact, precision-built package of horsepower. Before an engine leaves the Allison plant, it goes through a series of rigid tests to make certain that its performance will be exactly as it is intended. It is in the testing of these engines that the production test operator comes into the picture.

Each engine is mounted in a specially constructed concrete test cell adjoining an observation and instrument room. In the test cell the engine is sent through a series of closely observed test runs.

During these test runs various pressures and temperatures are observed and recorded from the instrument panel; brake horsepower at different speeds and under various conditions is determined; specific fuel and oil consumption is calculated for different conditions; acceleration, idle, and dive tests are performed; operations under various propeller settings and speeds are checked. During each test run, instrument readings, observations, and calculations are recorded on the engine test log sheet.

The thing that makes the test operator's job so tough is the fact that he (or she) must be constantly alert and conscious of several things at once. Attention must be constantly focused through the observation window on the operating engine and on the control panel. At the same time, the story of the test run is recorded by the operator on the test log sheet in the form of numerous instrument readings and calculations. The slightest deviation from normal operation must be kept within the specification limits allowed. The test specifications must be followed to the letter. There are no allowances for guesswork. On and about the control panel in front of the operator there are 79 instruments and controls, a number of which, although with a wider range of calibrations, correspond to those found on the instrument panel of a P-38 Lightning, P-39 Airacobra, P-51 Mustang, or P-40 Warhawk. There are also many additional controls, valves, warning lights, and special mechanisms in and about the test operations room that require the operator's attention at some time during the test runs. The mathematical calculations, such as brake horsepower, altitude ratings, specific oil consumption, specific fuel consumption, r.p.m., absolute dry manifold pressures, and others, are made during the test run.

In order to make this job adaptable to women, certain mechanical checks formerly made by the men operators during the test runs, such as examination of the distributor, magneto inspection, inspection for oil leaks, spark plug inspection, examination for loose connections, and others, have been taken out of this job and placed in another. We anticipate the women operators' being able to handle these checks later as they become more familiar with the engine and its mechanical construction. Since the beginning of the program some mathematical calculations have been simplified from slide rule and formula calculations to a series of reference tables.

Where They Come From

The majority of trainees are selected from qualified women in other jobs in our plant; however, a promising applicant found to be qualified by the employment department is given thorough consideration. The processes of selection are handled in this manner:

The performance records of women who have completed courses in engine mechanics, engine theory, shop mathematics, blueprint reading, and others given in the training program are examined by the training director's staff. The absentee records of those with promising ratings, along with other personnel records, are given careful scrutiny. Women selected through records and ratings come in for an interview with the training director, who makes the final selection.

We have not drawn any conclusion as to the type of experience prior to Allison employment that would be particularly beneficial, because the women trained so far have had no experiences of a mechanical nature in peacetime activities. Their experience ranges from no job experience to clerical positions and school teaching. Most of our women in this work come from Allison jobs with inspection classifications.

The Best Age Grouping

As far as an age group is concerned, originally our qualifications were set at from 20 to 40. Experience has taught us that a better age grouping is from 26 to 38.

One point of particular interest may be brought out in the discussion of trainees for test operations work, and it was the same with both men and women. The individuals selected should not have educational qualifications and even other qualifications too high above those actually required. At the beginning of our training program for women the educational requirements were set higher than necessary. Women hired to these high qualifications made an excellent showing through the training period. Then some of them, even before they were at the point where they could handle the job with proficiency, started looking around for something better, using their training as a steppingstone.

The training schedule is set up to extend over a period of six weeks, divided between classroom and test operations room. It is intensive and geared to meet the needs of the job.

Two instructors lead, demonstrate, and conduct all instruction and discussions, with the exception of the special instructors at the Allison service school, who give approximately eight hours of special training. The classroom instructor, who previously taught basic engine training and had a background in teaching physics and mathematics, was given further training in Allison engine testing and familiarization, and handles the classroom work. The test operations instructor, an engineer with comprehensive knowledge of the Allison engine test development and associated technical details, conducts the test operations training with the help of the classroom instructor.

The classroom instruction includes aircraft design, elementary physics, basic engine theory, slide rule instruction, test instrumentation, interpretation of engine test specifications.

The training in the test operations room is divided into two phases:

1. *Engine Operation*—preparation procedure for stopping and starting the engine, setting the engines for

Women do a better job when they know the "why" of their work. Trainees get a chance to sit in the pilot's seat and see the connection between the instruments he uses and those on their test panels

idling, warm-up procedure, instrument reading and setting, throttle control, propeller pitch control, practicing and completing test operation runs.

2. *Paperwork*—repeated computations for various calculations to be made, practical problems from data taken, lettering of engine test log sheet, determination of brake horsepower, interpretation and use of engine test specifications, familiarization with limits encountered, repeated practice on preparation of the engine test log sheet. This paperwork is spread over four weeks with blackboard diagrams and instruction. Trainees concentrate on this phase according to a progressive outline, while others in the group are going through the engine operation practice schedule in rotation.

The trainee's first day in the test operations room is a general familiarization period to become accustomed to the surroundings. The group is conducted in a tour over the test cell bank area viewing the different conditions surrounding the testing of Allison engines. This gives them a better conception of the scope of their job. The tour ends at the test operations room adjacent to the test cell containing the "workhorse" engine assigned for training purposes. From this point the training gradually expands, keeping pace with the progression of the classroom work.

The weekly schedule goes like this:

1st week—Classroom. No instruction in test operations room.

2nd week—Terminology study; instrument location; controls and warning lights; relative importance of the instruments; blackboard diagrams of oil and coolant system, temperature and pressure points, stabilization of oil temperatures, preparation procedure for stopping and starting the engine; repeated practice in stopping and starting by each trainee.

3rd week—Each trainee completes the first two of a series of eight training operation runs that progressively require increasing skill to perform. For example, training Operation Run No. 3: (a) Prepare and start engine, check instruments, raise coolant and pump up oil; (b) warm up engine and stabilize at 2000 r.p.m. and specified absolute dry manifold pressure as soon as possible, set throttle and adjust propeller pitch; (c) decrease speed and absolute dry manifold pressure to 1700 r.p.m. and 19.6 inches of mercury in manometer, set throttle and adjust propeller pitch, record no data, make one-half minute r.p.m. check; (d) raise speed and absolute dry manifold pressure to 1800 r.p.m. and 20 inches of mercury, set throttle and adjust propeller pitch; (e) raise speed and absolute dry manifold pressure to 1900 r.p.m. and 21 inches of mercury, set throttle and adjust propeller pitch; (f) reset at 2000 r.p.m. and specified absolute dry manifold pressure and record one complete line of data on the engine test log sheet; (g) stop engine according to procedure and prepare as if for removal of engine from test cell.

4th week—Complete training operation runs Nos. 3, 4, and 5, follow schedule of paperwork instruction.

5th week—Complete training operation runs Nos. 6, 7, and 8, follow paperwork training schedule, instructions and practice in taking oil samples, and laboratory analysis procedure.

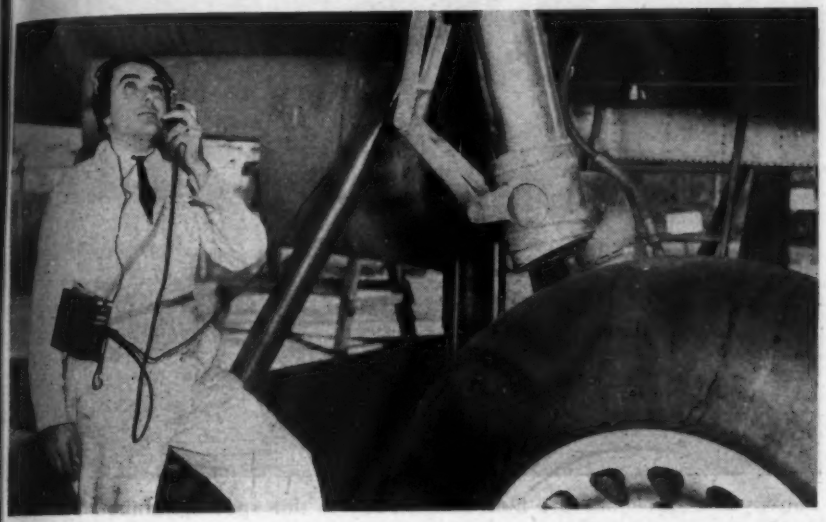
6th week—Each trainee is introduced to her foreman. The instructor in the presence of the trainee goes over with the foreman an outline of work the trainee has been given. The trainee begins actual production engine testing with further coaching, at first working as a relief operator.

In addition to the training we have mentioned, the trainees receive additional instruction lasting approximately eight hours at the Allison service school. Here the service school instructors explain, with cutaway sections, the various types of propellers used on the Allison engine, the complete engine, superchargers, subassemblies, and other parts. Trainees are allowed to sit in the pilot's seat of one of the service school's P-38 Lightnings. Here the direct connection between the pilot's instruments and those on the test operator's panel is shown.

Many things mentioned concerning the training schedule may sound irrelevant to the testing of engines, but we have found this to be true: Women do a better job when they know the "why" of their work and its importance in providing our pilots with quality, dependability, and power.

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for



With an interphone, one mechanic can tell his team mates just what is going on

A "scrap" table heaped with carelessly made parts makes workers at Republic Aircraft Products Division, Aviation Corporation, Detroit, care-conscious. Spoiled work is displayed for all employees to see, and is looked over every two or three days by department managers and superintendents. A poster reminds all passers-by that "Carelessness Helps the Axis"

Portable Interphones Air War Production

SOURCE: Electronic Specialty Company, Los Angeles

Portable, self-contained electronic interphones play their part in the war effort by providing an efficient, time-saving method of communication between coordinating crews in aircraft plants.

In the building of planes, a mechanic working in the pilot's compartment can communicate with his assistants in the radio room, bombardier's cabin, tail gunner's compartment, or engine nacelle, and thus direct their work to coordinate with his installation or testing of equipment, or *vice versa*.

For the two-man riveting crew, which includes a bucker and a riveter, the interphone permits the rivet-gunman to direct his assistant on the opposite side of a huge skin covering the fuselage or wing. Or, when rivets are not properly placed, the bucking barman can advise his team mate by direct telephone communication, rather than by hammer-signal instructions on the easily marred skin covering.

In the mating operation of subassemblies, where instant communication between the foreman of the mating crew and the craneman high in the loft is important, the interphone method permits the foreman literally to talk the huge section into its proper position.

•

Health Program Reduces Absenteeism

SOURCE: Cessna Aircraft Company, Wichita, Kansas

Absenteeism at Cessna Aircraft Company averages only 1.5 percent, or two persons out of every 300, according to Myron Russ, personnel director.

Much of Cessna's success may be attributed to its health program—which includes inoculation against typhoid, vaccine to prevent the common cold, salt and vitamin tablets.

A completely equipped first aid room gives immediate treatment to all injuries and illnesses. Safeguards are provided for all machinery; special safety equipment, such as steel-toed shoes, safety gloves, goggles, hats, and masks, removes the danger from hazardous jobs.

A War Transportation Committee sees to it that every employee has a way of getting to work. This committee also acts as a clearing house for those who want rides,

and those who have cars and want passengers. Assistance is rendered in obtaining gasoline rations, tires, licenses, stamps, and even various types of insurance.

The personnel department had nurseries and playgrounds organized, so that mothers could safely leave their children during working hours.

•

Filing System for Employee Suggestions

DON CHIVERS, Management Control, Lockheed Aircraft Corp., Burbank, Calif.

One of the major problems in any suggestion system is the proper filing of employees' proposals after investigation has been completed. The filing at Lockheed Factories A and B is done in numerical order—that is, in the sequence in which they were first received, in the specially constructed file shown.

One copy of the control slip, typed at the time the proposal is received, is used for code filing in a standard metal file. This coding is based on the type of problem which the proposal involves, and serves as a cross index to the numerical file. These two files make it possible to locate previously received suggestions and to assist in analyzing the major problems presented.

The cabinet, built of non-critical materials, was specifically designed to hold the proposals in manila folders in groups of 50. Tabs on these folders are marked 50-100, 101-150, and so on. These tabs are attached in such a manner that they graduate upward to the right in groups of three. This makes for ease in reading. Also, if a folder is out of place, the tab is out of line, revealing the fact immediately. Files are on top of storage cabinets, which makes every folder within easy reach and thus expedites filing. A shelf is provided by the projection of the storage cabinet, which makes a work space for filing.

Employee suggestions are filed numerically in this special cabinet. Tabs that graduate upward in groups of three make misplaced folders easy to spot

•

Misrouted Parts Kept Separate, Not Scrapped

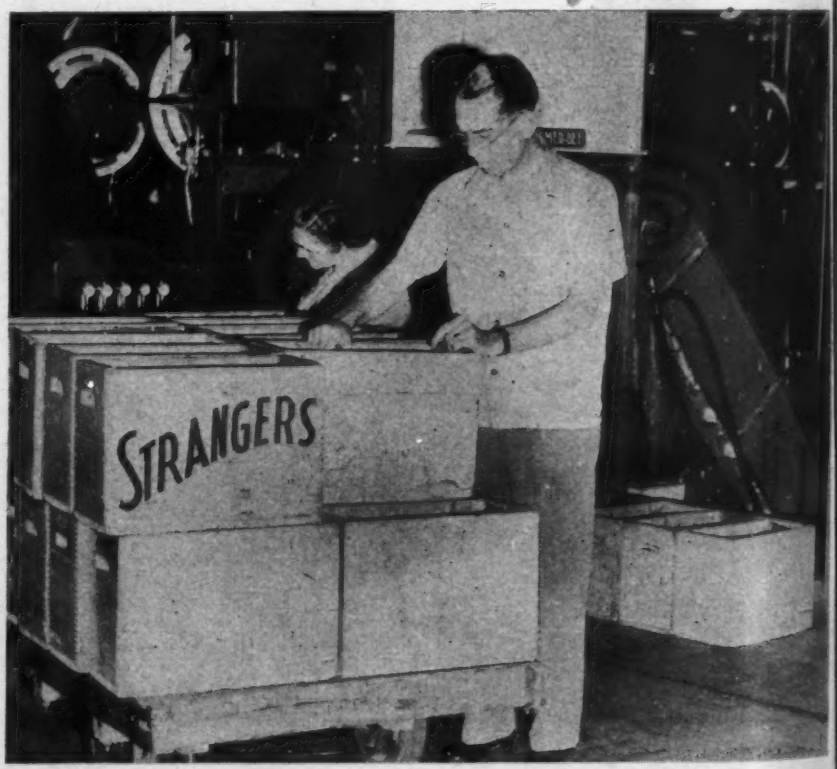
LUCIUS FLINT, Los Angeles

Through adoption of an unusual collection system, the Denver Ordnance Plant, operated by the Remington Arms Company, is saving around $20,000 a month in parts that might otherwise be lost or discarded.

Manufacturing 30-cal. ammunition, the plant handles in various stages of manufacture millions of small parts per week. Thus, it is inevitable that at times certain parts will be misrouted.

Instead of discarding these "misfits" as scrap, the Denver plant has developed a simple system for collecting them and returning them to the right place. Beside each press or other cartridge-making machine is a box marked "Strangers." When the machine operator finds something that does not belong to his department, he simply tosses it into the box. At the end of each shift, trucks are brought around to pick up the boxes.

The full boxes are taken to a central department where contents are sorted and redistributed, thus avoiding the scrapping of materials which have been partly processed and have merely gone astray.



Misfit parts are salvaged by means of boxes marked "strangers" standing at operators' desks. Contents are collected, then sorted, and redistributed to correct department to avoid scrapping of partly processed materials

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
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Director of Circulation:
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FACTORY MANAGEMENT AND MAINTENANCE
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

MAINTENANCE as the Editors See It

Decentralization Offers Important Advantages

MORE WORK for the maintenance department and less manpower with which to do it, has not been altogether without advantages. Out of that situation has come the need to study the organization and functioning of the maintenance department with a critical eye, in order to utilize the available manpower more effectively.

Decentralization is one answer that has been applied and found effective in a number of large plants. It involves placing one or more electricians or mechanics, or both, in important departments. These men are made responsible for keeping in good condition all equipment in that department or area under the care of the plant maintenance department. The remainder of the maintenance force is stationed at maintenance headquarters to handle repairs and all other work.

Not all plants would find it desirable, or profitable, to handle maintenance in this manner. Where it is applicable, however, several advantages accrue. One is the distinct lessening of downtime when something goes wrong in a department that has its own maintenance men. Work to correct the trouble starts at once. And there is no time wasted by maintenance men in going from maintenance headquarters to the department in trouble. Furthermore, men who are dealing with the same equipment day after day soon get to know its weaknesses, and where it is most likely to give trouble.

Also well worth considering is the easy fixing of responsibility for carelessness or neglect. That situation gives anyone a strong incentive to keep on his toes.

See That Electronic Devices Get the Right Maintenance

KEEP ELECTRONIC EQUIPMENT CLEAN. Avoid subjecting it to severe vibration.

The importance of observing these two principles probably is well known to those who have used this kind of equipment long enough to become thoroughly familiar with it. Those to whom such equipment is new will do well to accept these maintenance principles on faith, without trying to prove them the hard way.

This is not intended to imply that electronic equipment requires more maintenance attention than other electrical apparatus. On the whole, it requires less maintenance. One reason is that it has few moving parts, and usually they are smaller than those found in other kinds of equipment. Furthermore, the transformers, reactors, capacitors, and most of the other elements of electronic equipment are rated to give almost indefinite life, with a minimum of maintenance.

The tubes are an obvious exception. They have to be replaced at rather long intervals, but an occasional inspection and test is about all they need in the meantime.

Despite the fact that controls and other equipment may sometimes give little trouble when exposed to excessive amounts of moisture or dirt, such conditions definitely jeopardize continuous, trouble-free operation. With the high-impedance circuits found in electronic devices, dust or moisture, or both, may conduct sufficient current to throw things out of gear and make proper operation uncertain or impossible. Hence the need to keep panels and parts clean.

Severe vibration is detrimental to most kinds of equipment and the electronic variety is no exception. Vibration tends to shorten tube life and loosen connections or break leads—all highly undesirable, but easy to avoid.

A small amount of the proper kind of attention will go a long way toward keeping such equipment in first-class condition.

Faulty Blueprints Are Little Better Than None

WHEN WATER began seeping up through the ground floor of an old plant, a glance at a blueprint showed where the offending water main was supposed to be. Men were put to work digging it up. But first they had to tear a good-sized hole in a comparatively new concrete floor. Digging failed to uncover the pipe.

Two more holes had to be dug, which meant two more holes in the concrete floor, before the main was located. The answer is, of course, that someone failed to bring the blueprint up to date when the main was moved.

In another recent instance, a lot of unnecessary trouble was caused by failure to make an accurate layout of some underground oil lines. An out-of-date blueprint was misleading, rather than helpful. Hence the work that had to be done took two or three times as long as it should have.

During the past two years radical changes have been made in the size and location of the power and service lines in many plants. In many instances these changes have undoubtedly been properly recorded. And yet, since such changes or additions frequently were made hurriedly under heavy pressure, it is a safe bet that not all were duly noted.

Some of these days the time for reconversion will come around. It will mean radical changes in some plants, relatively minor ones in others. Whether the changes required are extensive or minor, up-to-the-minute blueprints will be worth many times their cost.

If you are not certain that yours can be depended upon, better get someone working on them.

Organizing for Preventive Maintenance

THE MAINTENANCE PROGRAM of the Denver Ordnance Plant actually began long before ground was broken for the first building. This plant is a government-owned facility supervised by the Ordnance Department, United States Army, and operated by the Remington Arms Company. The products are various types of 30-cal. ammunition. As one of the early specially built ordnance plants of the present war, this establishment was designed with a great deal of thought for maintenance as well as for production. The necessity for a complete preventive maintenance program as an aid to production was recognized, and all basic facilities for developing such a program were provided.

★The well-maintained plant is the high-production plant

When Building No. 1 went into production, its maintenance department went into operation at the same moment. Ample space for maintenance shops had been provided. Maintenance equipment was in and ready to go long before production machines were on the line.

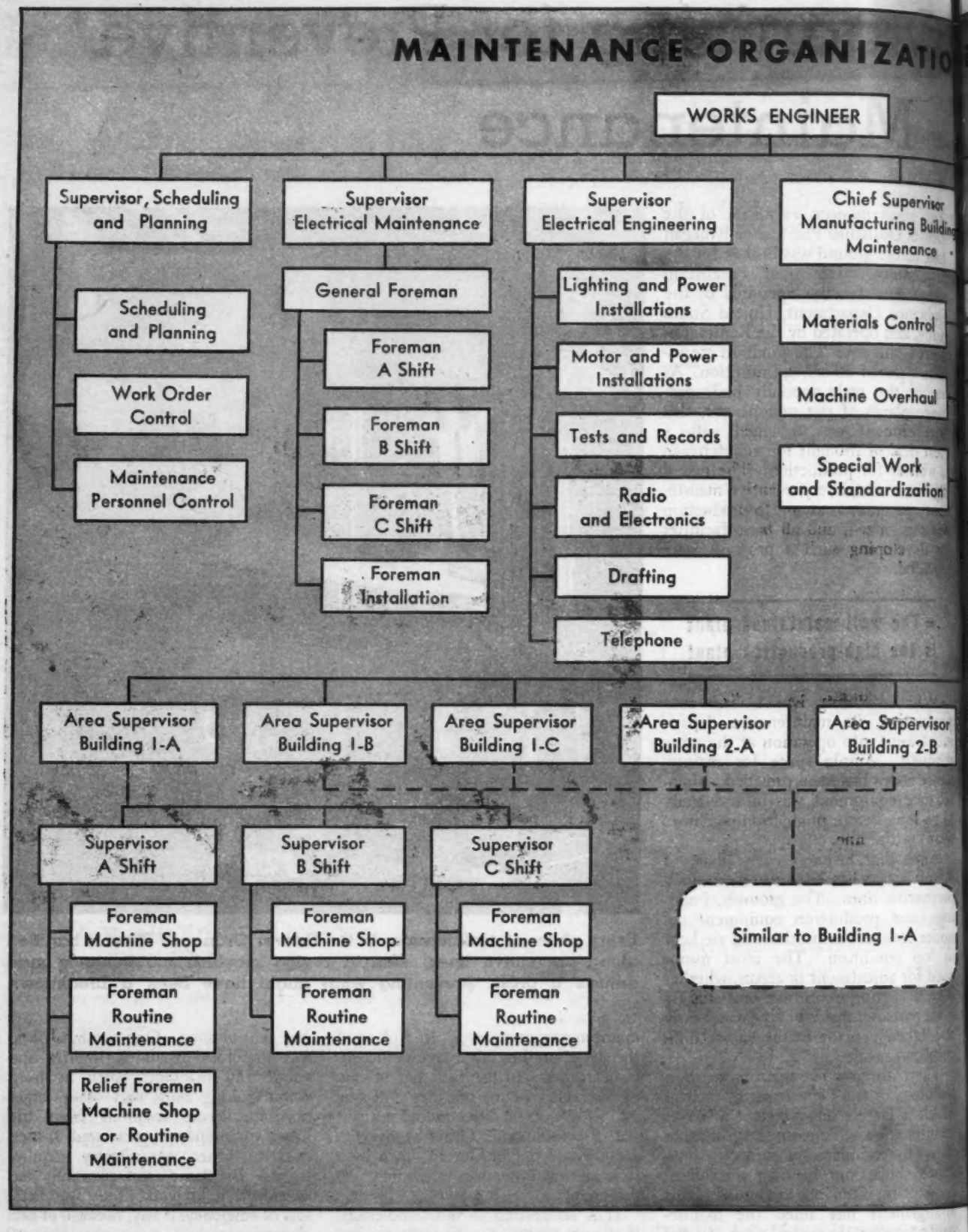
Since that first day every phase of maintenance has been handled along preventive lines. The grounds, buildings, and production equipment are under constant inspection and are kept in top condition. The most minor need for adjustment or repair, whether it be a sagging doorhinge or a slightly worn part in a machine, is caught early and taken care of before major difficulty can result.

There are now five main production buildings of the Denver plant, each of which is largely self-sufficient as far as maintenance is concerned. Each has its own complete machine maintenance shops and its own specialized crews of maintenance personnel. This arrangement has aided the maintenance program in several ways. In the first place, this type of decentralization saves a vast number of man-hours. Maintenance personnel and their equipment are closer to the machines they service. Thus, little time is lost in transit. Obviously, this condition aids production as well as conserving maintenance manpower. In a plant of this type another advantage of decentralization lies in the fact that in case of emergency in any one area only one set of service facilities would be put out of commission. Other production areas would not be slowed down by a lack of maintenance equipment or personnel.

Every phase of maintenance in the Denver Ordnance Plant is handled along preventive lines. Here a roving machine maintenance man adjusts a press, preventing what might have been a breakdown

It is interesting to note, moreover, that as a means of aiding the general war effort, the Denver plant has contrived to get along without some of the heavy maintenance equipment originally intended for its various buildings. It was found that certain types of jobs that do not require immediate attention could just as well be brought to one central shop. One overhaul shop was therefore expanded slightly and about 180 machines, such as horizontal rolling mills and other larger machines, were removed from the other maintenance areas and turned over to other war-industry requirements. By the careful planning and organization of work, there was little loss of efficiency, if any, because of this change.

As indicated by the organization chart (Figure 1), all maintenance operations are under the direction of the works engineer. Reporting to him are the heads of seven different departments: (1) Scheduling and planning, (2) electrical maintenance, (3) elec-



trical engineering, (4) manufacturing building maintenance, (5) equipment engineering, (6) general maintenance, and (7) project engineering.

1. Work of the scheduling and planning department is just what the name implies—planning, scheduling, and control of all phases of maintenance; also the record control of personnel in the works engineering division.

2. The electrical maintenance department, not to be confused with the electrical engineering group, is responsible for all electrical operating and maintenance work. It is headed by a supervisor, over a general foreman who, in turn, supervises the foremen of all three shifts and an installation foreman.

3. The electrical engineering depart-

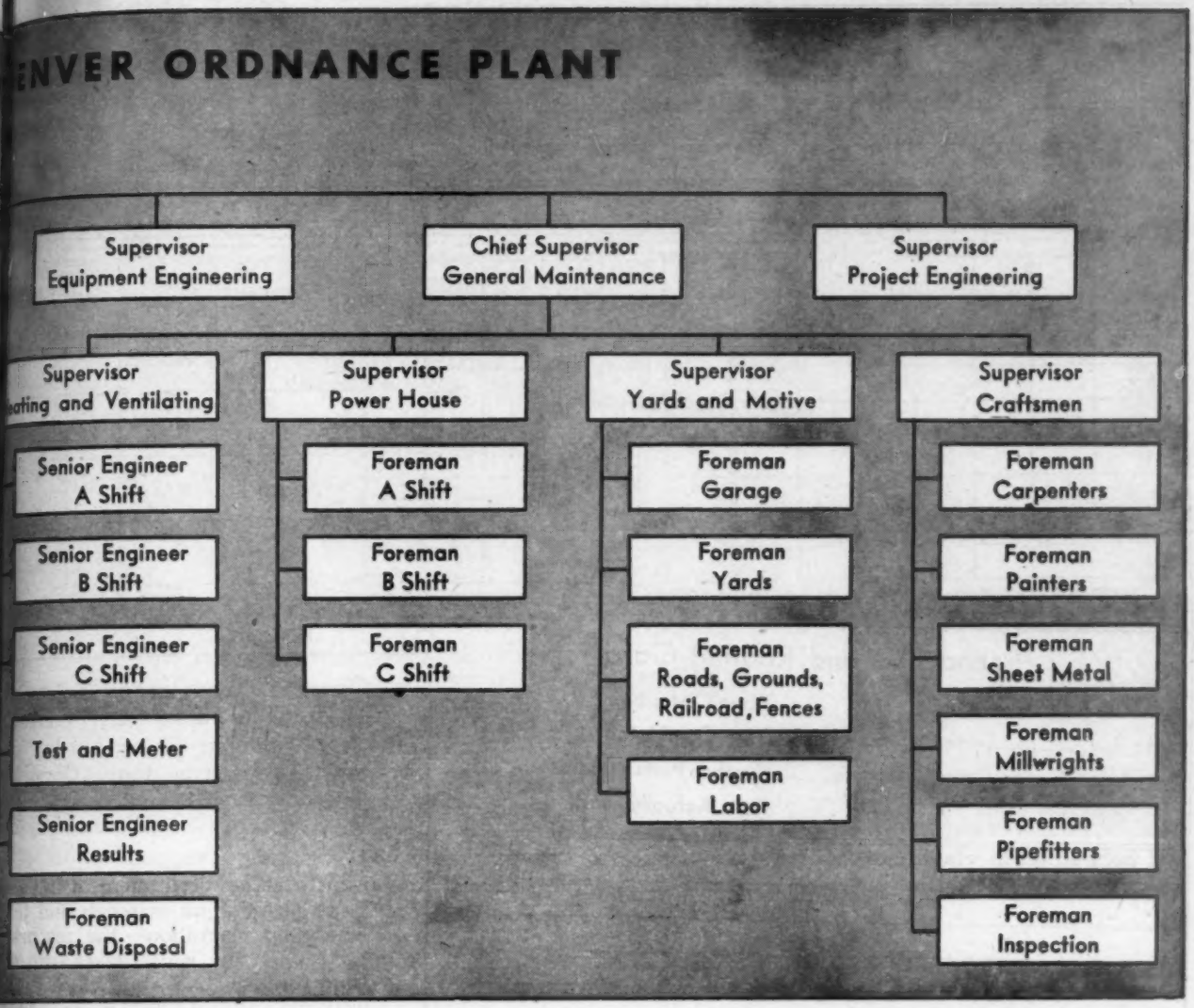


Figure 1. All maintenance operations are under the direction of the works engineer. Reporting to him are the heads of seven departments whose personnel totals more than 1000 employees

ment is responsible for planning and developing all types of electrical projects, such as lighting and power jobs, motor and power installations, test and records, radio and electronics, drafting, and telephone equipment. Each branch of this department operates as an individual unit.

4. The manufacturing building maintenance group is responsible for all phases of maintenance of production machines in all the manufacturing buildings, except the duties covered by specialized groups such as electrical maintenance. In each building this work is in charge of an area supervisor under whom is a supervisor for each shift. Each shift supervisor has direction over a shop foreman and a routine maintenance foreman. There are three "staff" adjuncts to the manufacturing building maintenance department, which serve the "line" units of all buildings—namely, the material control group, which handles contacts

Record Sheet of Machine or Part Alterations

Make of Machine	Cal. R. W. Mach. No.	Date Installed
		Bldg. No.
Reason for Alteration ( ) Safety ( ) Increase Production ( ) Lower Cost ( ) Improved Quality	Old Part No. _____ Old Dwg. No. _____ New Part No. _____ New Dwg. No. _____	Maintenance Labor _____ Material _____ Saving for Machine Year _____ Authorized by
Description of Change	Sketch	Remarks

Change requested by: _____
Name Title Dept.
Date Submitted: _____

Figure 2. Alterations on machines or parts must be requested on a special form, which shows reason for, and sketch of, proposed change

FILL IN ALL SPACES

WORK ORDER

FOR OFFICE USE ONLY

TO:

SERIAL NO.:

DATE: ACCT. NO.: DEPT.:

SCHEDULED COMPLETION: CROSS ORDER:

BLDG. NO.: EQUIP. No.:

DIRECT: INDIRECT:

DATE WANTED: ISSUED BY:

CARD NO.: TO DEPT.:

DESCRIPTION OF WORK:

CRAFT													
DATE													
HOURS													
LABOR													
MAT'L													
DATE													
HOURS													
LABOR													
MAT'L													

COMPLETED		ACTUAL	
DATE	HOURS		
SGN.	LABOR		
APP.	MAT'L		
	TOTAL		

PROD. DEPARTMENT | MAINT. OR EQUIP. SUPER. | WORKS ENGINEER

SERIAL NO.:

Scheduling and Routing Card

Job Number ____ Work Order No. ____

Date Rec. ____ Date Scheduled ____ Date Completed ____

Author ____ Cross Order No. ____ Number Parts to Be Made ____

Parts Actually Made ____

Description of Work: ____

Drawing No. ____

Material Required

Sequence of Operations

1	2	3	4	5	6

Tools Required for the Job

Figure 4. Scheduling and routing card stays with the job until it is completed. Reverse side is used as a progressive time record

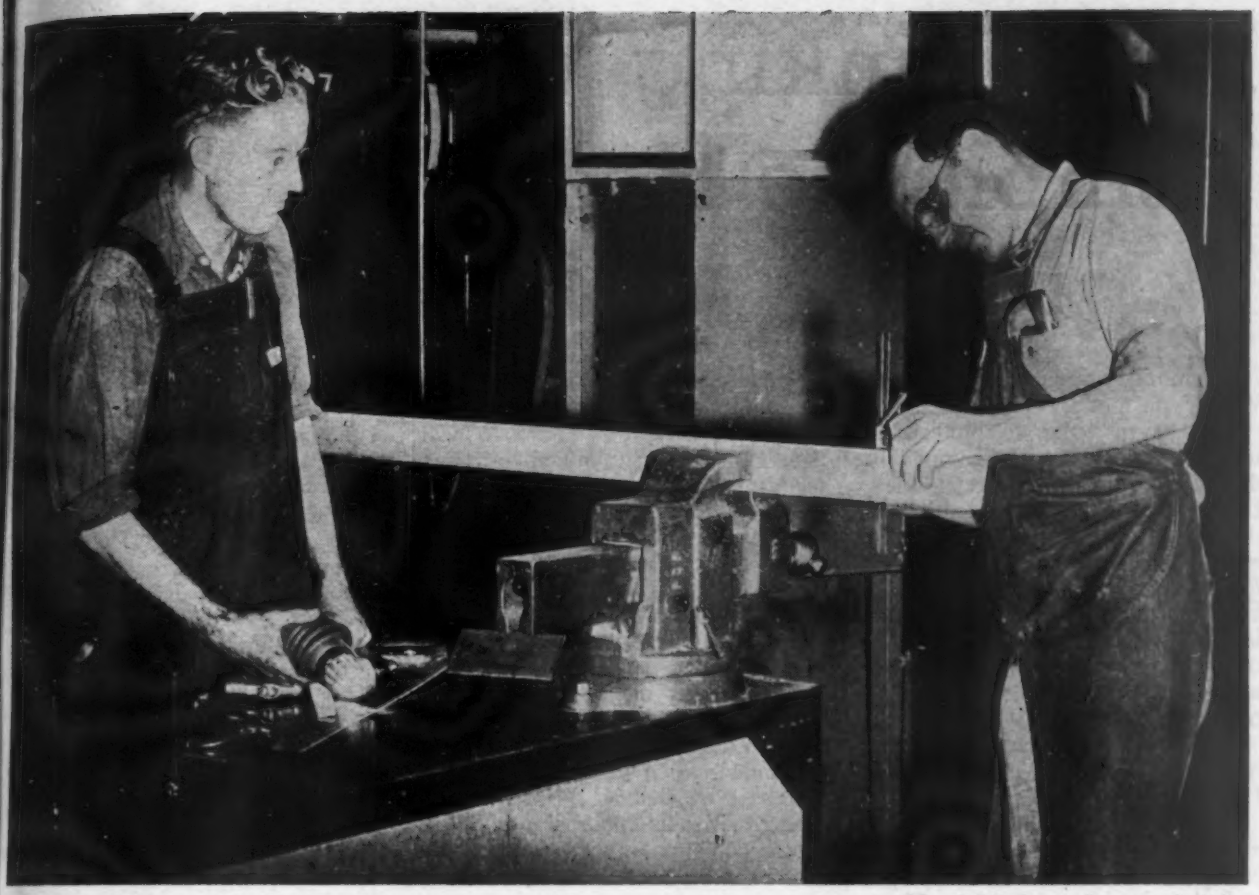
Figure 3. Work order is issued when job has been fully planned. Serial number shows order in which job is to be done. Completion date also is indicated

with the stores department, doing advance planning on materials and following up requisitions; the machine overhaul group, which takes care of major overhaul jobs; and the special work and standardization group, which analyzes and tests suggestions for equipment changes.

5. The equipment engineering department is mainly a research group, and is responsible for developing new ideas and improvements.

6. The general maintenance organization handles the bulk of the maintenance work not delegated to the manufacturing building maintenance group —for example, heating and ventilating, meters, the power house, yards, motive equipment, general building maintenance, roads, bridges, fences. Certain crafts employees, including carpenters, painters, sheet-metal men, millwrights, and pipefitters, all operate directly under the general maintenance chief supervisor.

7. The project engineering department functions principally in the coordination of all engineering and architectural design work relating to additions and alterations to plant facilities. It also prepares cost estimates for all projects, and acts as controller of actual expenditures by use of field checks and accounting records.



A lot of walking and plenty of time are saved by the use of portable workbenches, completely equipped with every type of tool likely to be needed by the maintenance man as he makes his rounds

Because it has an important bearing on keeping down costs and expediting maintenance performance, the work of the scheduling and planning department is of particular interest. This is the group that guides the "special work" phases of maintenance operation, such as machine alterations or process improvements.

Alterations on machines or parts must be requested on a special form (Figure 2) which provides information as to the reason for the request and gives a sketched description of the proposed change. If the change is one that would have a general application, it must first be considered by the special work and standardization group. If it applies only to one machine, however, it goes direct to the scheduling and planning office.

Here, a thorough investigation of the idea is made. If it proves sound, the duty of this group is to expedite its execution. If not, the department head who made the request must be sold on the reason for the rejection.

The investigation plan has not only saved from $5000 to $12,000 a month (which seems a small percentage of the cost of operations, yet is an amount well worth saving for the taxpayers) but it also results in having alterations made generally more effective than would otherwise have been possible. Often the first suggestion may not be sound, but may lead to something else worth while. Or there may be a better way of carrying out the idea than the one originally advanced. The function of investigation assures the development of all such possibilities.

Advance Analysis Made

Where an alteration is indicated, the scheduling and planning group makes a detailed advance analysis to determine what materials should be used and what is the best method of execution. The possibilities for using salvage and non-critical materials are always considered.

When the job has been fully approved and planned, the scheduling department issues a work order (Figure 3) to the proper area supervisor. That form bears a serial number to indicate the order in which the job is to be taken, also the date on which completion is desired.

From the work order data, which include a detailed description of the project, the area supervisor prepares a scheduling and routing card (Figure 4) that stays with the job until it is completed. Drawings, of course, accompany this form. Besides giving permanent file information and a description of the job, the routing card carries a list of materials required, a sequence-of-operations chart, and a list of tools needed.

As a job progresses from one machine to the next, or from one department to another, all pertinent data regarding it are constantly available. At a shift break it is possible for the new workman to carry on right where the first man left off. This form eliminates guesswork and uncertainty as to the objectives.

The effectiveness of the scheduling and planning group is such as to expedite all necessary maintenance jobs. Unsound ideas are promptly rejected. Best methods of doing necessary jobs are worked out. Materials are conserved. And, jobs of first importance are placed first. As a result, the plant's 3000 or more special jobs a month are handled as smoothly as the most minor routine maintenance operations.

(A March article will describe actual operation of the Denver Ordnance Plant's maintenance department.—Ed.)

Pure Drinking Water for Employee Health

M. A. NUSSBAUM, and R. M. STRIGER, Mississippi State Board of Health

IT IS THE DUTY of our factories to provide a safe and sanitary working environment in order to protect the health of employees. Unlike many industrial hazards, which affect the relatively few exposed to a particular toxic material, an impure water supply can seriously endanger the whole working force. That water-borne diseases such as typhoid and dysentery can be considered compensable injuries when contracted from a contaminated plant supply has been emphasized by a recent court decision (California Supreme Court; Parkhurst vs. Industrial Accident Commission etal, 129 P. 2d 113, decided September 24, 1942).

Where the potability of a public water supply is competently controlled, it is preferable to use that supply, at least for drinking purposes. Plants where private springs and wells are the sources of drinking water, however, must observe certain precautions to assure their potability.

Lead Is a Poison

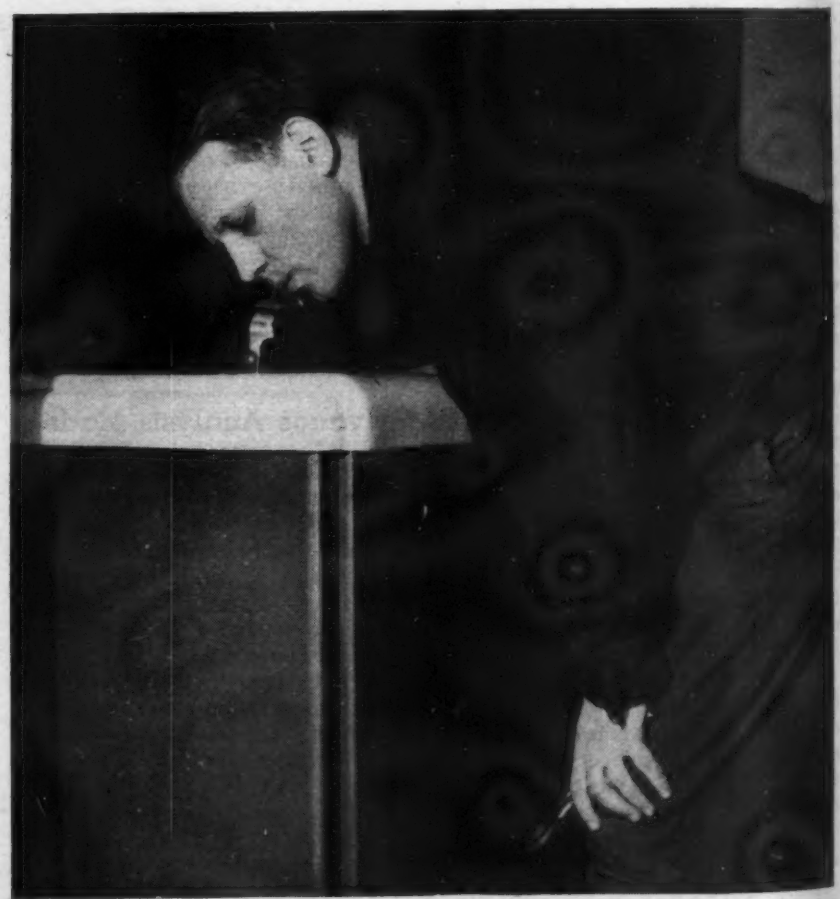
The bacteriological quality is the most important single index of a safe drinking water, but the possibility of chemically toxic constituents should never be overlooked. Lead is a cumulative poison. Concentrations as little as 0.1 to 0.2 parts per million of lead in drinking water have been known to cause poisoning. Old lead plumbing that is used to conduct very soft and acid waters containing appreciable quantities of carbon dioxide is dangerous for this reason. Fluorides in concentrations above one part per million also are objectionable, because such water taken over a long period of time may produce mottled tooth enamel.

The results of chemical and bacteriological examinations will indicate the need for, and the methods of, treatment. Adequate chlorination of a supply is a relatively simple and inexpensive means of purification and will render the water free from harmful bacteria. Frequently, palatability can be improved by the removal of substances producing tastes and odors.

The sources of water are either a surface or a ground supply. Surface waters, usually high in suspended solids and color, and always subject to contamination, can be developed inexpensively only if required in large quantities. A ground-water supply, usually free from suspended solids and color, and less prone to contamination than a surface water, is frequently used for securing private drinking water. This discussion will therefore be limited to the protection and treatment only of ground-water supplies.

The sources of ground water are springs and wells. All springs must be properly developed and protected from contamination, if safe water is to be produced. A shallow spring is quite limited in yield and, because of its superficial nature, is not satisfactory for industrial use. Deep springs are usually of a safe, sanitary quality because of the natural filtration and self-purification of the water. However, it is possible for a cesspool or privy to seep into the spring.

Design the spring-water collecting system, therefore, so that the entrance of possibly polluted surface water is prevented. Exclude superficial ground water and surface drainage by extending the wall of the spring basin above the top soil. Prevent the possible entrance of surface water by elevating the basin overflow pipe. Diversion ditches can be dug around the spring basin, and a small area around the basin fenced. Do not use limestone springs without providing for effective con-



One drinking fountain for every 50 employees, placed so that no long walks are necessary, is a U. S. Public Health Service recommendation

Drinking Water Standards

As approved by United States Public Health Service and the American Standards Association

1. There shall be provided in all places of employment an adequate supply of clean, cool, wholesome, and safe drinking water. It shall be readily accessible to all employees.

2. All water furnished for drinking purposes shall be from a source approved by the health authorities having jurisdiction. When such is not available, the state authorities shall furnish directions for rendering the water safe for human consumption.

3. In all instances where water is cooled by ice, the construction of the container shall be such that the ice does not come in direct contact with the water.

4. The common drinking cup is prohibited.

5. When individual drinking cups (to be used but once) are supplied, there shall be provided a suitable container for the unused cups and also a receptacle for disposing of the used cups.

6. Where sanitary drinking fountains are provided, they shall be of the type and construction approved by the health authorities having jurisdiction. New installations shall be constructed in accordance with Specifications for Drinking Fountains — Z4.2-1942, or the latest revision thereof, approved by the American Standards Association.

7. Open containers such as barrels, pails, or tanks for drinking water for general use, from which the water must be dipped or poured, whether fitted with a cover or not, shall not be allowed.

8. Where water, unfit for drinking purposes, is intended for industrial processes or fire protection, notices shall be posted stating clearly that such water is unsafe and not to be used for drinking, and every reasonable effort shall be made to prevent its being so used. There shall be no connection, open or potential, between a system furnishing water for drinking purposes and a system furnishing water for other uses, unless the latter is from a source approved by the health authorities having jurisdiction as being safe for human consumption.

tinuous bactericidal treatment; there is little natural purification of the water flowing through the fissures commonly found in these springs.

Wells may be classified into three general types—dug, driven, and drilled. Although dug and driven wells may be made safe by watertight concrete construction, the potential danger of surface pollution and their limited and variable yield make them unsatisfactory as sources of industrial drinking water. Drilled wells are satisfactory because their yield is large and the water is usually safe, cool, and clear. However, drilled wells in limestone formations should always be questioned as to quality until confirmed as safe by bacteriological examination of samples collected over an extended period. Observe the following general recommendations of the U. S. Public Health Service for the protection of ground water supplies:

1. Site of well not near pollution, such as sewers, cesspools, privies.

2. Proper design, for which the services of the State Board of Health are available for free consultation. Employ an experienced well driller.

3. Careful operation and maintenance. Make repairs immediately if cracks develop in the concrete structure. If the casings corrode to point of leakage, replace them.

4. No physical cross-connections with polluted supply.

5. Protection against flooding. Pump floor a minimum of 2 feet above high water, and the casing carried above floor and closed at the pump head. The high water contour 50 feet from the well, with drainage away from the well. A protective housing placed over the well or a weatherproof installation made.

6. No toilet or septic tank drain in the immediate vicinity.

7. Well casing watertight and sealed into an impervious stratum, and not used as suction pipe.

8. Before placing wells in operation, disinfect with chlorine to protect against contamination incurred during construction, and check quality of water by bacteriological examination.

Consult the State

The state agencies concerned with problems of a potable drinking water supply are the departments of health and labor. Regulations governing drinking water facilities usually have been established by one or both of these departments. The state health departments are fully equipped to offer specific advice to any industrial plant on approved types of wells, water treatment, emergency chlorination, drinking fountains, and plumbing fixtures. These departments have the personnel and laboratory facilities for making routine sanitary inspections and for the collection and examination of water samples without charge. Samples for chemical and bacteriological analyses of drinking water should be taken several times a year to determine the need for purification.

A more recently developed state service is that offered by the Office of Civilian Defense, one of whose functions is to assist in the wartime protection of industrial plants, including the safeguarding of water supplies. Suggested precautions that would minimize the possibility of malicious contamination include covering and locking storage reservoirs, locking pump houses, fencing premises, frequent inspecting of water facilities, ample guarding, and chlorinating.

The value of a safe water supply can be diminished by the lack of adequate and well-designed means of delivering such water to the employee. To place a safe water in an open pail or barrel, or in direct contact with ice of questionable cleanliness, or to provide a common drinking cup, will contam-

Plants where private springs and wells are the sources of drinking water must observe certain precautions to assure the water's purity

inate the drinking water. A study to determine whether improperly designed drinking fountains may transmit disease-producing bacteria, has recently been reported. The conclusions of this investigation were that such fountains "may store as well as transmit pathogenic microorganisims." These findings have demonstrated that slow drainage, misuse of the drinking fountain bowl (as a receptacle for waste material), low water pressure in the jet, and splashing would make possible the transmission of infection to users of the fountain.

A complete program for a pure drinking water supply includes installing sanitary drinking fountains.

The essential features in the construction of such drinking fountains, as set down by a joint committee of the American Public Health Association and the conference of State Sanitary Engineers, may be summarized:

1. Construct fountains of a material that is easy to clean and keep clean.

2. Place orifice of the fountain above the edge of the bowl, inclined at an angle from the vertical, and protected with a mouth guard.

3. Provide waste opening and pipe of sufficient size, with a strainer and a trap.

4. Install enough fountains and be sure they are readily accessible.

Keeping drinking fountains clean is one of the functions of good plant housekeeping. Space fountains to avoid unnecessarily long walks for the employees. Although it is not entirely relevant to our discussion, a salt tablet dispenser should be placed near the fountain during hot weather to assist in the proper distribution of needed salt. The number of fountains depends upon the area of the plant and the size of the working force. The acceptable standard of the number of fountains in a plant, according to the U. S. Public Health Service and the U. S. Department of Labor, is based on the ratio of 1 to 50 employees.

Bottled water sold to plants is usually under the control of the health department. However, it is well to inquire into the source of the water and the manner of handling; bacteriological samples of such water should be collected to check its quality and the adequacy of treatment given the bottle. Do not cool bottled waters by direct contact of the water with ice.

It has been reported that over 10 percent of water-borne disease outbreaks occurring from 1920 to 1937 in this country were due to the contamination of the water in the distribution system. In most of these cases the contamination had reached the system through cross-connections with auxiliary sources of water. A cross-connection is defined as a physical connection between a distribution system of a public or private potable water supply and a private or secondary non-potable supply.

The rigid rule is that all cross-connections should be eliminated. However, where the extra water or pressure is absolutely necessary for firefighting, only a permissible type of cross-connection should be installed, and that only under the approval and supervision of no less than state authorities. After such emergency use, it is essential that the drinking water supply system be flushed thoroughly with a chlorinated compound before its subsequent use.

How Contamination Occurs

Contamination of the drinking water supply by means of inter connections or defective plumbing fixtures may take place in numerous ways:

1. By the occurrence of a negative pressure in the supply pipes, causing back-siphonage of the contamination material.

2. By the development of a back-pressure in process equipment to which the water supply is connected.

3. Through the activities of birds or small animals in parts of the supply system that are open, or by dust that reaches water-holding devices.

Care must be exercised in the installation and operation of various mechanical plumbing appliances that may make possible the back-flow or back-siphonage of sewage or waste into the water supply system. The rules of "inlet above top of fixture" and "open discharge through a funnel on a drain" will help eliminate many unintentional interconnections. In this way the fixture is isolated from the source of water and from the sewage line. These principles are incorporated in the plumbing standards designed to keep drinking water pure, which appear in Codes A40.4–1942 and A40.6–1943 recently approved by the American Standards Association and developed under the technical leadership of the American Public Health Association and the American Society of Mechanical Engineers. Other devices such as air-inlet valves and check-valves are used to protect the quality of water delivered to a fixture. Plumbing regulations usually embodied in the local plumbing code or sanitary code specify acceptable fixtures and installations. This necessitates the employment of a licensed plumber and indicates the inherent danger of handy-man repairs.

Tests Tell What Size Motor

W. E. DORSCHELL, Chief Electrician, Pullman Standard Car Manufacturing Company, Hammond, Ind.

FITTING MOTORS to machines saves money. This has been the experience of Pullman Standard Car Manufacturing Company, which made a survey of all the motors in its Hammond, Ind., plant some time ago. Over a period of a few years we ran load tests on every one of the 1200-odd motors in our plant. The tests were made with a graphic wattmeter equipped to run either at a standard rate or at a fast rate to provide detail charts.

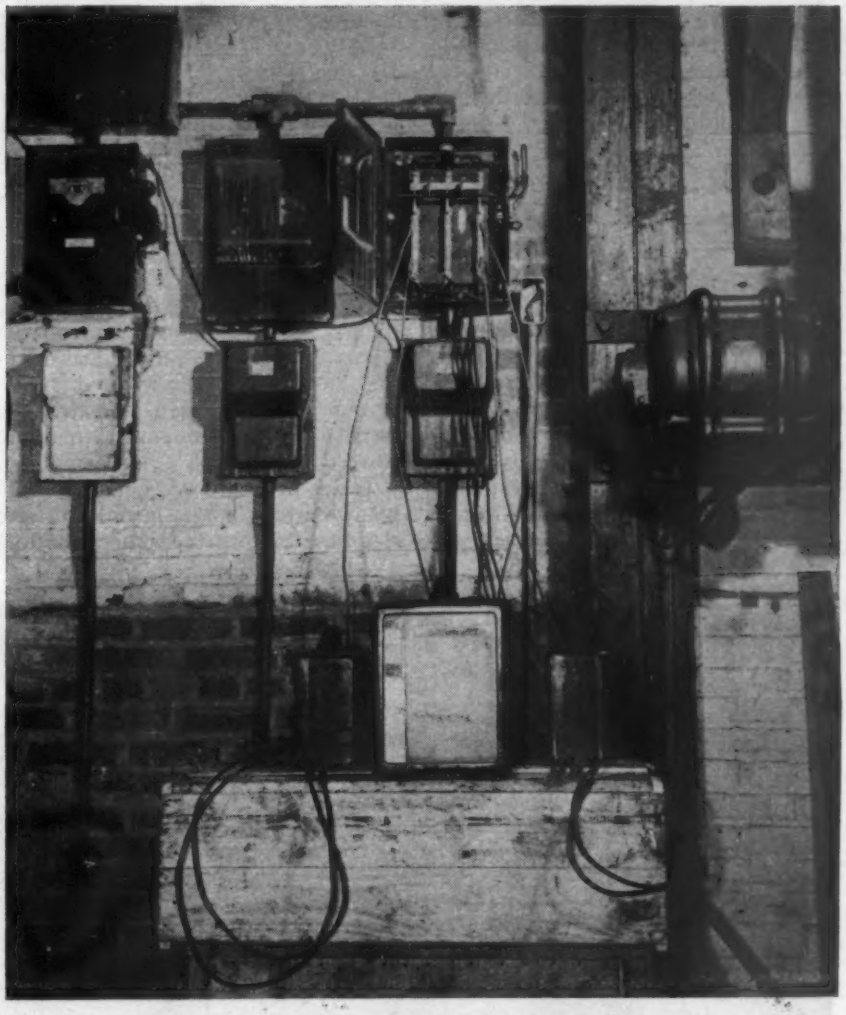
Load tests for most motors were run on standard charts for approximately four hours, and on variable loads for about eight hours. The fast charts were taken during these periods on the same chart strips, and each fast test covered a complete operating cycle of the machine whose motor was under test. Three or five fast chart tests were taken on each machine to determine its peak load, the duration of the peak, the frequency of the peak, and the severity of the starting duty. Three fast charts were always taken and when these showed widely varying conditions, two additional charts were taken to check the first three.

Average Used

Usually the high and low charts of the series of five tests were thrown out, and an average of the remaining three was used to determine the size and duty factor of the motor required. In some cases large motors with widely varying loads, as indicated on the five charts, were given additional tests to make certain that the correct motor size was determined.

The test equipment consisted of a three-phase graphic wattmeter, a set of current transformers of sufficient range to cover all motors in the plant, sets of dummy fuses with flexible leads to connect the current transformers, potential leads, leads with clamps for use where there were no fuses, and a few required tools. The two chart speeds of the wattmeter were quickly available and thus it was a simple task to make the fast chart tests once the meter had been connected to the motor under test.

Tests were conducted by the same group of men under direct supervision of the electrical engineer. All motors were tested before the charts were analyzed and recommendations made.



Checking the load on a 5-hp. motor driving a pipe threading machine with a graphic wattmeter. Dummy fuses in the switch are cartridge fuses with links removed and the meter leads connected to the ferrules

Of course, each chart was identified and conditions at the time of the test were written on the chart. Manufacturers' recommendations on motor sizes and speeds for machines actually in use at the plant were requested by mail during the test period. When the charts were analyzed, the recommendations we had received from the manufacturers were compared with the results of the load tests. In general, the two figures were quite comparable, although in some cases the recommended motor sizes were considerably different from the sizes indicated by the tests. A few motors were tested a second time to verify accuracy and, unless there were unusual circumstances, the tests were used as a basis for remotoring.

All the charts were studied to determine what motors needed to be changed. It was found that about 40 percent of all the machines were overmotored, whereas about 5 percent were undermotored. Many of the overmotored machines had the nearest standard motor size, since the next smaller motor would have been severely overloaded. All such motors were left unchanged. It appeared advisable to change more than 200 of the motors, of which 67 were considerably oversized.

As the charts were studied, the machines with incorrect motors were

listed. The motor and control then on the machine were made a part of this list. When the list was completed motors of the right size were assigned to the machines. Many motors of the proper size were taken from our maintenance stock; some of the mators were exchanged with other plants of our company; and some new motors and controls were purchased. The correctly sized motor, as determined by the tests, was applied to every machine. All motors were available for immediate use in the plant before the change-over was started.

Standardized Speeds

In planning the remotoring, consideration was given to standardization of speeds as well as to sizes. Thus where a group of several motors of the same horsepower rating were to be used, motors of the same speed were installed. This standardization necessitated some changes in the drive mechanism, and materials were obtained for making these changes. Some equipment previously lineshaft-driven was altered to group or individual drive. Here, again, the equipment was selected and in the plant before the changes were started.

When all the motors, gears, belts, starters, and wiring equipment were on hand, the maintenance department started the job of changing the motors. The complete change-over required about four months and involved the removal of existing motors and installation of the others. Changes in the mounting framework and supporting structure were frequently required. Flat belt drives were often changed to the V-belt type. Some belt drives were altered to gear or direct drives. In each case, these shifts involved mechanical changes.

It was necessary to change the ratio of a gear drive when motor speed changes were made. This was done either by removing the gears and cutting new ones or buying and installing gears of different sizes in the old cases. Whenever individual drives were installed to replace lineshaft operation, load tests were run after the installation had been made to insure correct motoring.

It was necessary, of course, to make many starter changes in order to give the new motors the proper starting facilities. In every case where a motor was changed, the old overload protection was altered or changed to assure complete and adequate protection to the new motor. Many old starters were in use throughout the plant. Most of them were replaced whether the motor was changed or not.

Some of the motor changes made are well illustrated by two examples. We have a group of five machines, identical in every respect, doing the same work with the same material. When originally tested, the motors on these five machines ranged from 35 to 50 horsepower. The load tests on each of these machines indicated a normal peak of aproximately 38 horsepower. The 35-hp. motor was overloaded and the machine with the 50-hp. motor was overmotored. Only one of the machines was provided with a motor of the correct size—40 horsepower. Based on the 38-hp. load test, 40-hp. motors were installed. In each case a starter change was required.

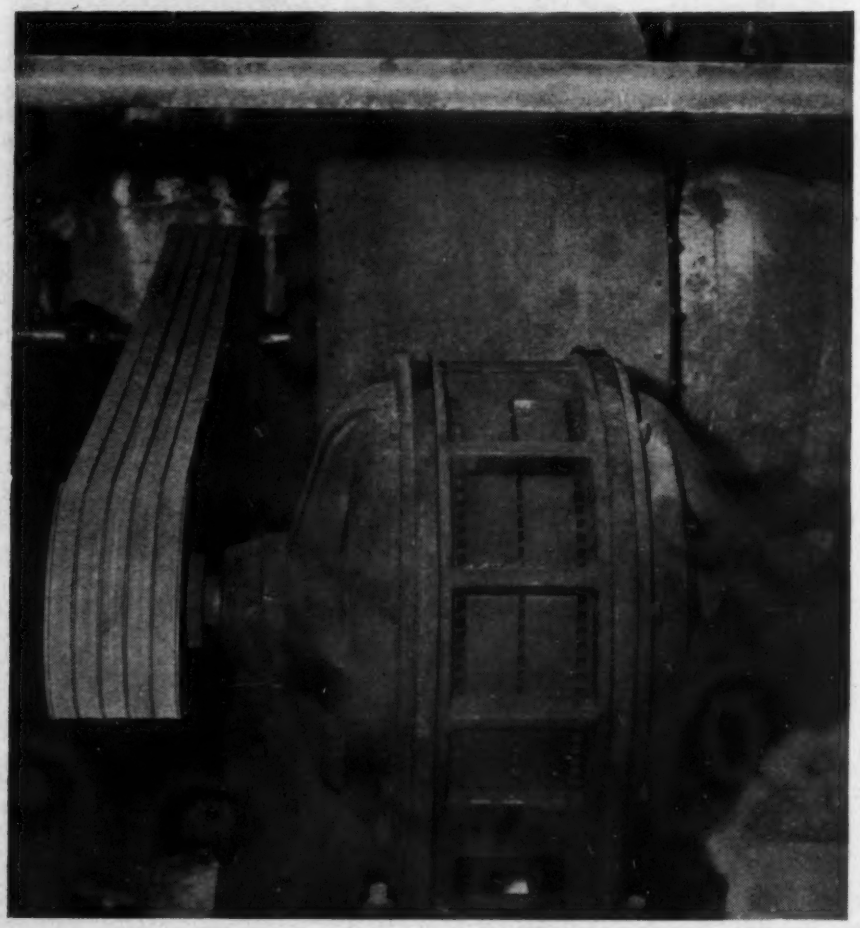
New Motors Required

Another group of identical machines on identical work were driven by 5-, 7½-, 10-, and 15-hp. motors, respectively. Tests showed that all these motors had a load of about 7 horsepower; hence a 7½-hp. motor was required. It was necessary to purchase five new 7½-hp. motors for this group of machines.

There were apparently two reasons for overmotoring; either that of overcautiousness in supplying the original motor, or the emergency installation of any motor available in the maintenance repair shop and failure to replace it later with a motor of the proper size and type.

We do not now permit an oversized motor to remain in service for any length of time. Load tests are constantly being run wherever production procedure is changed or new equipment is added. When it is necessary to change a motor for repair work, a load test is run and an oversized motor is ordered changed.

We feel that these motor changes were well worth making. We have gained in several ways. We purchase power on a rate that includes a power factor penalty clause. Under the old conditions, the monthly penalty amounted to 5 percent per month on the demand portion of the power bill. Due to the improvement in power factor by proper motor loading, this penalty no longer exists. The over-all efficiency of the utilization of electric energy has materially improved and is reflected in the lower consumption of kilowatt hours per unit produced.



Tests showed that the 60-hp. motor which drove a shaving exhaust fan was larger than need be, so a motor rated 50 horsepower replaced it

How to Get the Most Out of

MECHANICAL POWER TRANSMISSION EQUIPMENT

To insure the right amount of production at the right time, keep mechanical power transmission equipment always ready for effective operation

FACTORY MANAGEMENT AND MAINTENANCE *PLANT OPERATION LIBRARY No. 68*

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TO GET THE MOST OUT OF *Bearings*

ANTIFRICTION

1. Handle Bearings Carefully

Ball and roller bearings are precision-made devices and must be treated as such. Careless handling before or during installation can easily damage them seriously. Store in a dry clean place. Do not drop. Do not unpack until ready to install.

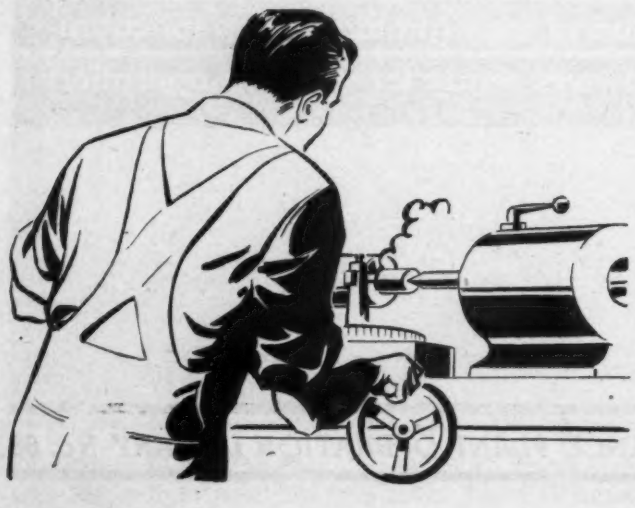
2. Apply Bearings Correctly

Antifriction bearings in general are designed to carry primarily a radial or a thrust load. Hence a radial bearing may have only limited capacity for handling thrust loads, whereas the ability of a thrust bearing to stand radial loads may be still more limited.

Rapid failure is likely to follow imposition of an excessive load or the wrong kind of load.

3. Make Shaft Shoulders True

If dirt, burrs, or anything else prevents the inner race from making contact all around with the shoulder, the bearing will not be square with the shaft. It will then be subjected to destructive stresses.



4. See That Shafts Are Straight

If they are not, rigidly mounted bearings will be subjected to stresses that will soon destroy them.

5. Install Bearings Properly

The inner race usually is a press fit on the shaft. A loose inner race will cause shaft peening. Too tight a fit will require excessive pressure in installation, may damage the race.

Bearings may be installed in a press, exerting pressure against the inner race, or by tapping the outer end of a piece of pipe slipped over the shaft and bearing against the inner race.

If bearings are heated to facilitate installation, do not let the temperature go above 200 degrees Fahrenheit.

The outer race usually is given a clearance fit in the housing.

6. Seal Bearings Adequately

It is important to prevent lubricant from leaking out of a bearing. Of equal or greater importance is the necessity for keeping all foreign matter from making its way in. Many kinds of seals have been developed to meet the different conditions encountered. Select a method of sealing that will give ample protection.

7. See That Supports Are Rigid

Unless bearing housings are firmly bolted to a rigid support, movement and vibration may be permitted that will markedly shorten bearing life.

8. Lubricate Bearings Properly

A necessary first step is to make sure that a suitable lubricant is employed. On this point it is a good plan to follow recommendations of the bearing or lubricant manufacturer.

Antifriction bearings need lubrication only at intervals whose frequency is determined by conditions. Avoid over-lubrication. It will cause heating and other troubles.

PLAIN

1. Select Right Bearing Metals

Such factors as bearing pressure per square inch, speed, and operating temperatures must be taken into account when selecting a suitable alloy for lining plain bearings. In view of the changes in composition that have been made necessary by the shortage of tin, it is advisable to seek the recommendations of reliable manufacturers.

2. See That Linings Are Skillfully Poured

Satisfactory results depend to a large extent on the care and skill with which the bearing shells are cleaned and tinned, maintenance of the proper pouring temperature (overheating speeds up oxidation of the metal), and correct alignment.

3. Fit Bearings Correctly

A small but definite clearance must be allowed between the shaft and the bearing lining. Good practice, based on experience, dictates that the clearance range from 0.002 inch for shafts 1 inch in diameter and

smaller, up to about 0.009 inch for 6-in. shafts. Excessive clearance leads to leakage of lubricant and promotes pounding.

High spots, too, must be scraped down and the lining made to conform closely to the shaft.

4. Pay Attention to Grooving

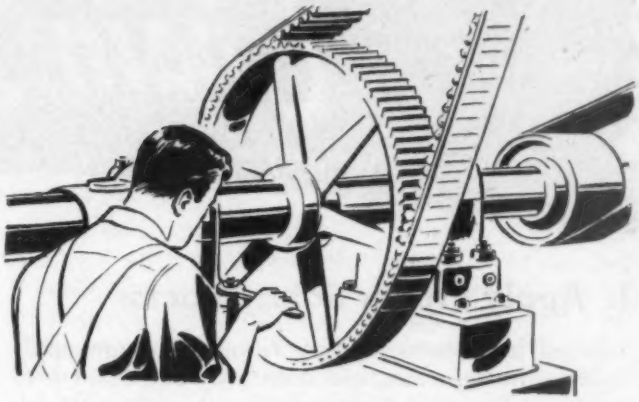
Maintenance of a film of lubricant in plain bearings depends largely on the location of the oil grooves. When grooves are properly cut they provide an adequate, well-distributed supply of oil slightly in advance of the pressure area. Improperly located grooves tend to destroy rather than to maintain continuity of the oil film.

5. See That Shafts Are Aligned

When shafts are bent or out of alignment they impose stresses that are harmful, increase heating and wear.

6. Provide Rigid Supports

Lack of rigidity in supports, or failure to bolt bearings down firmly, tends to allow movement that is harmful from the standpoint of bearing wear.



7. Provide for Adequate Lubrication

Plain bearings may be lubricated with either oil or grease. Both have their advantages and limitations. Whatever type of lubricant is used, see to it that all bearings are serviced regularly. Proper lubrication is the most important factor in obtaining long life from bearings.

DON'T'S

1. Don't overload any bearing
2. Don't use inferior lubricants
3. Don't operate unprotected bearings in dirty places
4. Don't let shafts remain bent or out of alignment
5. Don't put bearings in inaccessible places
6. Don't mount bearings on supports that are unsteady

CONDITIONS TO LOOK FOR ON INSPECTION

1. Need for lubrication
2. Amount of wear
3. Excessive heating
4. Pounding or unusual noise
5. Leakage of lubricant
6. Cleanliness of shaft and housing
7. Need for more effective sealing
8. Tightness of bolts
9. Alignment of shaft
10. Condition of lubricant in reservoirs

TO GET THE MOST OUT OF *Chain Drives*

1. Apply Proper Safety Factor

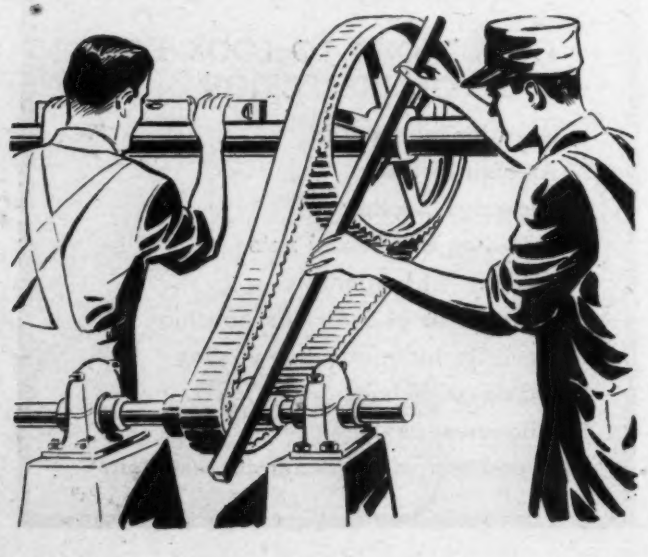
Listed horsepower capacity ratings of chains apply under normal operating conditions. When a chain drive is subjected to shock loads and other severe service conditions, it is necessary to make an allowance by using a stronger chain. Watch out for this point when service requirements become more severe by reason of higher speeds, feeds, or other changes in production processes.

2. Provide Way to Adjust Tension

Chains elongate slightly after they have been in use, and it is desirable to take up the slack. The ease of adjustment made possible by slide rails for the motor will pay for them. Use of idler sprockets is usually to be avoided, although they are effective when properly installed.

3. See That Shafts Are Parallel and Level

For minimum wear and long chain life, it is essential that shafts be parallel and sprockets in line with each other. Make sure that motors and bearings are held rigidly in place, and that their supports are strong and stable.



4. Use Odd-Toothed Sprockets

Silent chains are commonly furnished with an even number of links or pitches. The life of the drive will be increased if the sprockets have an odd number of teeth.

5. Avoid Extreme Conditions

Use of driver sprockets having a minimum number of teeth, or driven sprockets having a maximum number, is not advisable. Extreme speeds are likewise usually undesirable. If necessary to employ them, get the manufacturer's recommendation. Extra-high ratios are prone to be troublesome. When necessary, consider the advisability of making the reduction in two steps.

6. Maintain Proper Tension

In general, chains require less tension than would be needed for a belt. The amount of tension required varies with conditions. When the load is jerky, tension has to be increased to avoid whipping. Under ordinary conditions the slack strand may be on either the upper or the lower side. When centers are short, it is advisable to let the lower strand take the slack. This is true also with long-center drives using small sprockets.

Vertical drives are to be avoided when possible. If necessary to use, the chains must be kept fairly taut.

7. Cover Chains in Dirty Places

Dirt and dust, particularly when they are of abrasive nature, will increase wear. Also they tend to clog the working parts. Enclosing the chain in a dust cover will give sufficient protection in many instances.

8. Keep Chains Clean

When chains are not protected by an oil-tight casing they tend to become coated with a gummy mixture of dirt and lubricant which must be removed at intervals. This can be done by scrubbing in a suitable solvent, followed by a rinse in clear solvent. After draining thoroughly, let chain soak in an oil bath long enough for the oil to penetrate between all working parts.

9. See That Lubrication Is Adequate

Common methods of lubricating chains range all the way from occasional applications of lubricants by hand to forced feed by a pump mounted in the housing. The type of chain, speed and rating of the drive, and the amount of exposure to dirt are important factors in determining the method of lubrication required. Drip cup or sight-feed lubrication is frequently used on both open and enclosed drives, and is satisfactory for many installations. Use of splash lubrication, in which the chain dips into a pool of oil, also is common. When a bath is used, the case must be drained, flushed out, and refilled often enough to insure that the chain is lubricated with clean oil.

10. Replace Excessively Worn Sprockets

When sprockets become badly worn there is danger that the teeth will be stripped or the chain will jump and the drive will be seriously damaged or destroyed. It is economy to replace sprockets before they reach this condition.

With roller chains it is sometimes possible to reverse sprockets to present unworn tooth faces. Or, teeth that are worn into a hook-shape may be ground to remove the hook.

When chains are replaced, worn sprockets must also be reconditioned or discarded to prevent serious damage to the new chain.

11. Consider Use of a Break-Pin Sprocket

If a chain drive is likely to be subjected to excessive stresses, such as might be caused by jams, the chain and other equipment may be damaged or broken. Under these conditions it is advisable to use a sprocket containing a shear pin. When the load exceeds a predetermined value the pin connecting the hub and the rim of the sprocket will break and take the load off the drive.

DON'T'S

1. **Don't operate chains above recommended speeds**
2. **Don't impose excessive or long-continued overloads**
3. **Don't use sprockets smaller than recommended**
4. **Don't use excessive reduction ratios**
5. **Don't operate chain on shafts with worn bearings**
6. **Don't let chain operate with excessive slack**
7. **Don't impose excessive tension on chain**
8. **Don't run a new chain over worn sprockets**
9. **Don't expose chains to dirt or fumes**
10. **Don't use too-heavy or inferior lubricants**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Alignment of shafts and sprockets**
2. **Rigidity of motor and bearing supports**
3. **Amount of wear on chain and sprockets**
4. **Cleanliness of chain and sprockets**
5. **Amount of tension on chain**
6. **Need for lubrication**
7. **Condition of lubricant in casings**
8. **Condition of casings and guards**
9. **Unusual noise or vibration**

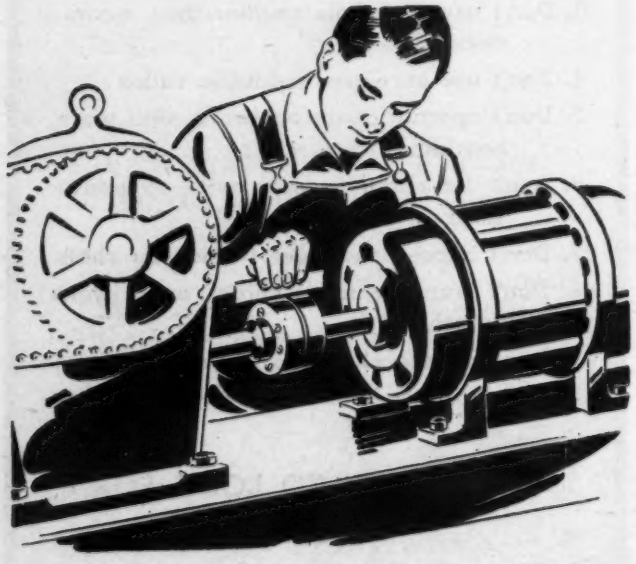
TO GET THE MOST OUT OF *Gear Reducers*

1. Provide Substantial Support

Unless the foundation or support is sufficiently rigid and strong to prevent it, vibration will cause increased gear and bearing wear, noise, and trouble with couplings. Also, it will be impossible to maintain proper alignment of shafts.

2. Align Shafts Carefully

Misaligned shafts impose on bearings and couplings heavy stresses that lead to abnormal wear and early failure. When motors and reducers are mounted on a common bedplate the problem of maintaining alignment is much simplified. The bedplate must then be carefully aligned with the driven machine and securely bolted down if the connection is by coupling.



3. Connect Shafts by Flexible Couplings

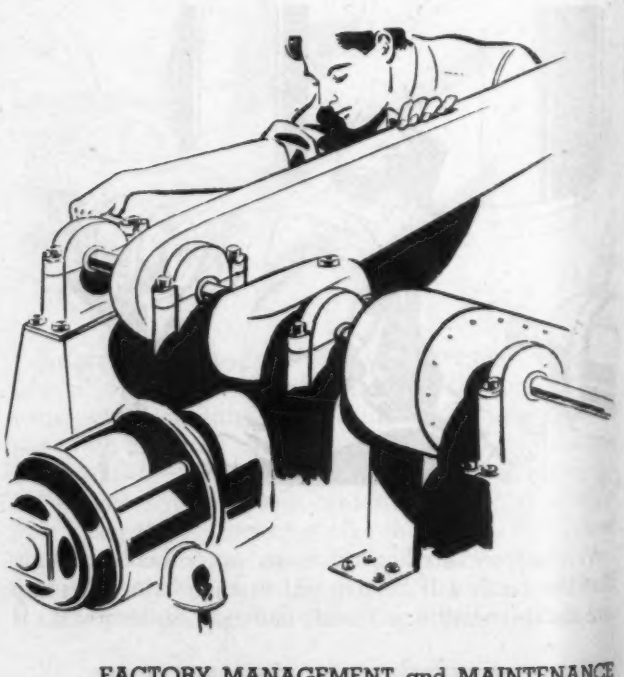
Since it is difficult to secure and maintain perfect alignment between the gear reducer and the motor and machine shafts, it is advisable to use a coupling that will compensate for a small amount of misalignment. At the same time, flexible couplings ought not to be required to compensate for all the errors caused by careless installation.

4. Allow Shaft End Float

Motor shafts are permitted a small amount of end float. Machine shafts are also usually allowed a slight endwise movement. Hence, motor, gear reducer, and machine must be separated sufficiently, and the flexible couplings must be installed, so that the coupling halves will not strike each other under any conditions.

5. Provide Outboard Bearings for Overhung Loads

Bearings of gear reducers intended to be direct-connected are not designed to carry heavy transverse loads. Therefore, it is not advisable to mount pulleys, gears, or sprockets on the shaft unless the load on the reducer bearing is cut down by an outboard bearing.



6. Apply Proper Service Factor

Ratings commonly given to gear reduction units are based on eight to ten hours' running daily in service that does not impose shock loads at frequent intervals. For other conditions such as those involving more hours of operation daily, or recurrent shock loads, it is necessary to divide the listed rating by the appropriate service factor in order to determine the rating of the unit required.

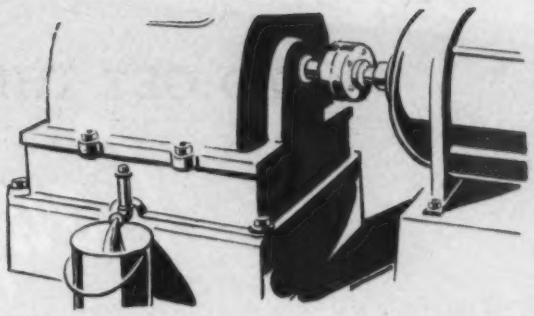
7. Fit Couplings and Sprockets Carefully

Any parts placed on the shaft of a gear reducer unit must fit so tightly that keys or setscrews will not throw them off center, thus giving rise to binding or vibration. Too tight fits, on the other hand, will require use of excessive force or pounding and may injure the bearings and other parts. When assembling such parts it is advisable to remove the bearing cover plate on the other side of the unit and back up the shaft, in order to protect the bearings and gears.

8. Be Sure to Use the Proper Oil

In gear reduction units the oil serves both as a lubricant and as the medium for carrying away the heat developed by the gears. The viscosity of an oil and its load-carrying capacity decrease as its temperature goes up. Therefore, it is necessary to use an oil that will protect the gears and bearings at the operating temperature of the unit.

In general, a fairly heavy, high-grade oil is required under normal operating conditions.



9. Change the Oil Regularly

Since the oil in the reservoir of a gear reducer is used over and over it inevitably becomes contaminated and must be filtered or replaced at intervals. Under ordinary operating conditions this may need to be done only at intervals of three to six months. If conditions are severe, such as high temperatures or exposure to a steamy atmosphere, more frequent filtering or replacement will be required.

Keep the oil level at the proper height. Do not allow level to go over top of gage or above upper petcock. An excessive quantity of oil in the reservoir will cause heating and leakage. Check the oil level when unit is at rest. When checking the oil level it must be remembered that the level in the gage will be lower when the unit is running than when it is at rest.

DON'T'S

1. **Don't overload gear reducer**
2. **Don't install loosely fitting couplings or other parts on shaft**
3. **Don't pound heavily on shafts when installing parts**
4. **Don't subject shafts to bending stresses**
5. **Don't let unit get out of alignment**
6. **Don't use improper or inferior lubricants**
7. **Don't let oil level rise too high**
8. **Don't let the reducer run dry**
9. **Don't let air vent holes get plugged**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Tightness of bolts and screws**
2. **Misalignment of unit**
3. **Amount of bearing wear**
4. **Excessive operating temperature**
5. **Unusual noise or vibration**
6. **Condition of oil in reservoir**
7. **Need for lubrication**
8. **Oil leakage along shaft or elsewhere**

TO GET THE MOST OUT OF *Couplings*

1. See That Coupling Is Designed for the Operating Speed

Some couplings are designed for high speeds, others for low speeds. Trouble is likely to result if a low-speed design is used in high-speed service, and *vice-versa*.

2. Make Sure Coupling Is Suitable, if Subjected to Shock

Not all flexible couplings are designed to withstand shock loads. Therefore, if the service imposes shocks it is important that the proper type of coupling be selected.

3. Use Coupling Adapted to Starting Load

Some loads require a high starting torque. Others have to be brought up to speed slowly, for one reason or another. Some types of couplings are not well suited for such service, and may not give satisfactory results.

DON'T'S

1. **Don't expect flexible couplings to compensate for excessive misalignment**
2. **Don't use couplings not designed for the service**
3. **Don't put coupling flanges on undersized shafts**
4. **Don't fail to lubricate couplings that require it**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Amount of shaft misalignment**
2. **Need for lubrication**
3. **Cleanliness of coupling**
4. **Amount of wear**
5. **Unusual noise, vibration, or signs of trouble**

4. See That Coupling Flanges Fit Shaft Snugly

Flanges that fit loosely are likely to be thrown off-center by keys or setscrews and thus increase any tendency to vibration. There is also likely to be some movement of the flange, which in time will cause serious wear on both flange and shaft.

5. Be Sure That Misalignment Is Not Excessive

Some types of flexible couplings will safely handle a larger amount of misalignment than others. Also see that the coupling is adapted to stand the kind of misalignment, such as angular, lateral, or both.

6. Lubricate Couplings Properly

Not all designs of flexible couplings require lubrication, but it is essential for others. Neglect to give this attention when required will lead to early failure.

7. Keep Couplings Clean

Accumulations of dirt tend to interfere with proper functioning of flexible couplings and may be distinctly harmful. Therefore, it is advisable to disassemble couplings at suitable intervals, clean out all parts thoroughly, and examine them for wear.

TO GET THE MOST OUT OF *Clutches*

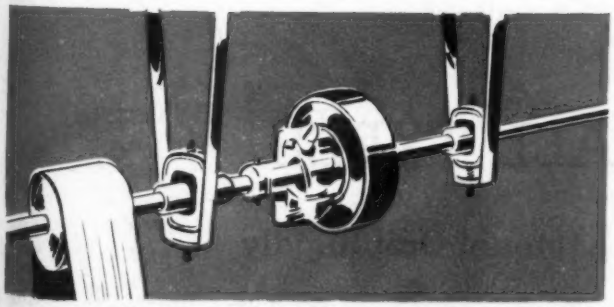
1. See That Clutch Is Adapted to the Service

Clutches may be designed to be operated only occasionally, or with almost any frequency. Imposing more severe duty on a clutch than it was designed to stand safely results in trouble and rapid failure.

2. Be Sure That Clutch Has Ample Capacity

In determining the required size or capacity of a clutch, account must be taken of the extra load imposed when starting, or by suddenly applied loads, as well as the normal working load. Since the starting load, say, may be more than twice the normal load, a clutch may be badly overloaded if only the latter load is considered in determining the capacity needed.

3. Be Sure That Shafts Are Properly Aligned



Correct alignment of shafts is essential to trouble-free operation of friction clutches employed as shaft cutoff couplings. This usually means that a bearing must be placed on each side of, and close to, the clutch.

4. Let Friction Clutches Pick Up Load Slowly

Normally, a few seconds are allowed for a friction clutch to bring the load up to full speed. Excessive heating and wear of the friction surfaces will result if a clutch is required to perform its functions in much less time. If loads must be applied suddenly, a clutch of larger capacity will have to be used.

5. Keep Clutches Adjusted

Friction surfaces wear down in time and eventually reach the point where slippage occurs. This results in excessive heating and loss of speed. Condition of friction surfaces and clutch adjustment should be such that the load is picked up easily and carried without slippage.

6. Provide Adequate Lubrication When Required

Oil or grease must not be applied to friction surfaces of a dry-type clutch, but clutch sleeve and other parts, depending on the type, require careful lubrication.

DON'T'S

1. **Don't operate a low-speed clutch at high speed**
2. **Don't underestimate maximum load to be imposed on a friction clutch**
3. **Don't operate a clutch oftener than its design permits**
4. **Don't make a clutch pick up its load too fast**
5. **Don't fail to make needed adjustments promptly**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Need for adjustment**
2. **Need for lubrication**
3. **Excessive wear of friction surfaces**
4. **Slippage**

TO GET THE MOST OUT OF *Variable-Speed Devices*

MECHANICAL

V-BELT TYPE

1. Use Proper Service Factor

Listed ratings apply to eight to ten hours' operation daily under ordinary conditions. When units must operate 24 hours a day, or are subjected to shock loads or frequent starting and stopping, a service factor must be applied in determining the horsepower rating of the unit required.

2. Keep Belts and Disks Clean

Dirt, grease, water—any foreign material—will tend to cause deterioration of the parts or interfere with their proper functioning.

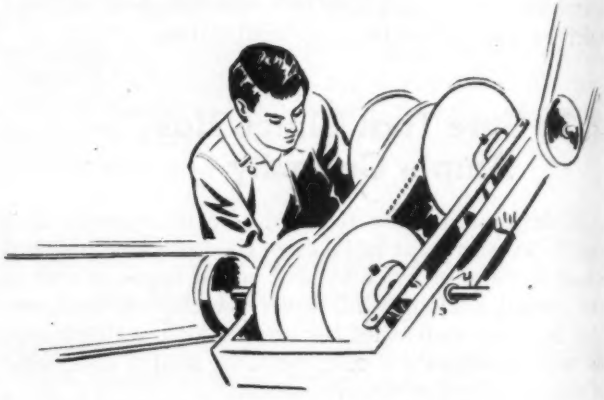
DON'T'S

1. **Don't overload variable-speed units**
2. **Don't try to shift speed when unit is not running**
3. **Don't run driven shaft above recommended speed**
4. **Don't try to get same horsepower output if speed of driven shaft is reduced**
5. **Don't use larger motor than specified for the unit**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Need for lubrication**
2. **Condition of oil in reservoir**
3. **Cleanliness of unit**
4. **Slippage**
5. **Excessive heating**
6. **Unusual noise or vibration**
7. **Excessive wear of any part**
8. **Alignment of shafts**

3. Maintain Proper Belt Tension



Keep the belt just tight enough to carry the load without slipping. The belt should sag slightly when running. Unnecessary tension will tend to shorten the life of the belt and increases the bearing load. If excessive tension is required to prevent slipping, the unit probably is overloaded.

ALL TYPES

1. Mount Unit Rigidly

Any movement under operating stresses will tend to disturb alignment and throw a heavy overload on bearings.

2. Be Sure That Unit Is Properly Lubricated

Lubrication requirements and the methods of meeting them vary with different designs of variable-speed devices. Manufacturers' recommendations should be followed closely.

TO GET THE MOST OUT OF *Lineshafting*

1. See That Shafting Is Properly Aligned

Hangers or other bearings that are out of line impose unnecessary, perhaps serious, stresses in shafting, as well as extra load on the bearings themselves. Increased power consumption and wear on bearings are inevitable.

2. Be Sure That Bearings Are Rigidly Mounted

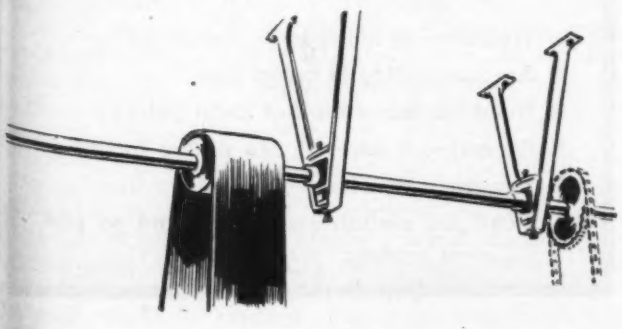
Loosely mounted lineshaft bearings will fail to hold the shaft straight, and therefore permit it to be subjected to abnormal bending stresses.

3. Provide Sufficient Bearings to Avoid Sagging

A lineshaft has considerable weight—enough to cause definite sagging if supports are more than a comparatively few feet apart. Abnormal deflection can easily lead to failure. Hence the advisability of setting bearings on 6- to 8-ft. centers which usually provides sufficient support for unloaded sections of shaft.

4. Support Lineshaft at Load Points

Pulleys and sprockets likewise are heavy, and thus tend to cause bending of a lineshaft. In addition, the belts or chains that operate on them exert a heavy pull. These effects can be offset only by placing bearings close to all points where power is received or taken off.



5. Do Not Overload Shafting

Shafts can be overloaded by imposing abnormal twisting or bending loads, or a combination of the two, as may happen when more pulleys are mounted on, and additional machines are supplied from, a lineshaft that is already loaded close to capacity. When the safe load on a shaft is exceeded, failure is likely to result.

DON'T'S

1. **Don't let lineshafts operate when they are out of alignment**
2. **Don't let hanger or other bearings get loose**
3. **Don't let spans between bearings be excessively long**
4. **Don't mount pulleys or sprockets midway between bearings**
5. **Don't increase load appreciably without checking capacity of shaft**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Need for lubrication**
2. **Need for realignment**
3. **Excessive vibration**
4. **Amount of wear on bearings**
5. **Rigidity of bearings and supports**
6. **Excessive heating of bearings**

TO GET THE MOST OUT OF Pulleys and Sheaves

1. Be Sure Type Is Suited for Service Conditions

Some types of pulleys and sheaves will resist excessive moisture, corrosive fumes, shock loads, and other severe conditions better than others. Trouble may be saved and better results all around attained by installing the type of pulley best suited to whatever unusual conditions exist.

2. Be Sure Pulleys Run True

Well-made pulleys and sheaves will run true when they leave the factory. Allowing them to fall, careless installation, or severe shocks in service may throw them out of line. This condition should be corrected because it tends to increase stresses on the pulley, create unbalance, and cause uneven running of belts.

3. See That Pulleys and Sheaves Are Tight on Shaft

Pulleys may be either keyed or clamped to the lineshaft. Regardless of the method used, it is essential that movement on the shaft be prevented, to avoid wear and damage to both shaft and pulley, or sheave.

4. See That Pulleys Are Balanced for Operating Speed

This precaution applies primarily when speeds are unusually high, say in excess of 4000 f.p.m. Some pulleys are regularly balanced for higher speeds, some are not. An unbalanced pulley, running at high speed, can cause highly objectionable vibration.

5. Give Loose Pulleys Proper Lubrication

Loose pulleys may be troublesome and a source of high maintenance cost because of neglect or the difficulty of lubricating them properly, due to poor design. If these conditions cannot be corrected it will be advisable to install one of the available designs in which lubrication is required only at long intervals.

DON'T'S

1. **Don't use pulleys unsuited to atmospheric or other conditions**
2. **Don't operate pulleys that are noticeably unbalanced or out of true**
3. **Don't operate pulleys that have become loose on shaft**
4. **Don't operate pulleys above recommended speeds**

CONDITIONS TO LOOK FOR ON INSPECTION

1. **Tightness of bolts, keys, setscrews**
2. **Amount pulley is out of line**
3. **Need for lubrication of loose pulley**
4. **Excessive wear of loose pulley bushing**
5. **Unusual vibration**
6. **Need for cleaning and painting to prevent rusting**

Network Distribution Gives Flexibility for Changes

C. E. PFLUG, Plant Engineer, Propeller Division, Nash-Kelvinator Corporation, Lansing, Mich., and P. B. SHIRING, Westinghouse Electric & Manufacturing Company, Detroit

SELECTION of a reliable and flexible electrical distribution system was one of the most important problems that arose when Nash-Kelvinator was asked, on short notice, to provide a factory to manufacture Hamilton Standard propellers. Three buildings were selected for the purpose: A, a shipping shed; B, a warehouse; and C, an oil house. Buildings A and C are three-story structures. In reconditioning these buildings, heating, sprinklers, sewers, gas, compressed air, ventilation, electric power, and lights had to be installed.

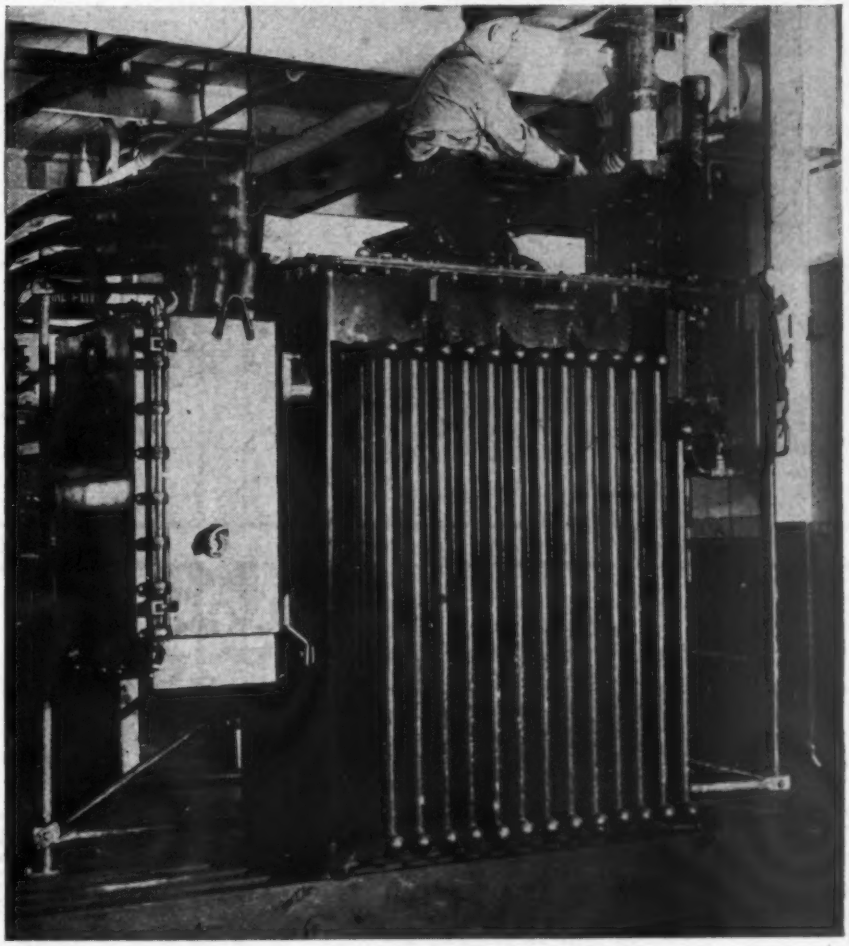
In determining the kind of electrical system to be provided, the experience of other automobile manufacturers was utilized and additional information was obtained from the Hamilton Standard Propeller Company. The total load was estimated at approximately 3000 kw. for power and 600 kw. for lights.

Flexibility Essential

Because electrical equipment had to be purchased before plant layout plans were finished, the distribution system had to be sufficiently flexible to take care of all loading conditions that might develop. A bus duct system was selected to provide power for the entire first floor and certain other parts of the plant where manufacturing operations were probable. With the bus duct system, feeders can be connected at convenient intervals to accommodate any concentration of load.

Power factor correction was economically necessary since the power rates are designed to give the customer the benefit. Capacitors with an aggregate rating of 1620 kva. were installed to provide a 92 percent average power factor. Units of 60 kva. capacity were distributed throughout the plant and connected to the bus duct. This method released valuable feeder and bus duct capacity.

The conventional radial power system was considered first. With this system the entire substation capacity would be placed at one location, and many secondary feeders radiating from that point would be required. This system was rejected because of the prohibitive cost in copper and switches. The voltage drop also would have been excessively high.



One of the 750-kva., liquid-filled network transformers. There are suitable provisions for two 500,000-circ. mil. 4160-volt primary cables

After considering another type of system the secondary network system was selected for several reasons: (1) Earlier shipment could be obtained; (2) price was comparable with the other two systems for this installation; (3) the network system had the flexibility necessary in a new factory where speed of construction is important. Time was not available to complete the factory layout before purchasing the electrical equipment.

Although 480-volt delta industrial network systems had not been used previously, the 220-volt network system has had long usage in the utility field and has proved satisfactory and reliable. An order was placed for five 750-kva. transformers and provision made for two 500,000-circ. mil 4160-volt primaries to which each transformer could be connected. A throw-over switch was provided so that load can be transferred from one feeder to another under no-load conditions.

An interlock, operating between the standard secondary network protector and this throw-over switch, was in-

stalled so that switching errors could not occur to jeopardize the equipment.

The network loop was designed to have a capacity equal to that of an individual transformer. It consists of three 350,000-circ. mil circuits in parallel, protected with current limiters. Twelve limiter boxes were inserted in this loop at convenient intervals. Loads and transformers were connected to the system through these boxes. The main incoming substation was located on the second floor of Building C. Two primary circuits, with adequate oil circuit breakers, feed the system.

In Building A, two transformers were located on the third floor, Figure 1, along with the six limiter boxes. The secondary loop connects these limiter boxes and was installed on the ceiling of the floor below. Bus duct feeders were installed straight down and connected to the bus duct on the first floor. The type of transformers used made fireproof vaults unnecessary.

Three transformers and six limiters were placed on the roof of Building B. The loop follows the roof trusses, and the bus ducts are directly below. Transformer platforms were fitted into the regular roof trusses.

The typical limiter box contains twelve sets of limiters—six for each tie line (in and out), three for the transformer connections, and three for feeder circuits.

The lighting system is supplied from a separate primary circuit and utilizes the conventional radial layout.

When the system was put into operation a number of faults developed in the wiring, and provided some valuable 480-volt operating experience. For instance, a fish tape pushed through a conduit shorted the hot bars in the bus duct. The mishap burned out a 400-amp. fuse but did not interrupt the system. Later, failure of a safety switch insulator caused the fuses to blow again without interrupting service. In both instances the faults occurred very close to the fused switches that protect the bus duct; hence they were subjected to relatively high short-circuit current values.

To date, there have been no faults on the system sufficiently large to cause the current limiters to function. Voltage has been exceptionally good, power continuity has been uninterrupted, and service has been satisfactory.

One Sunday while the whole system was down for readjustment, one transformer was put into service with-

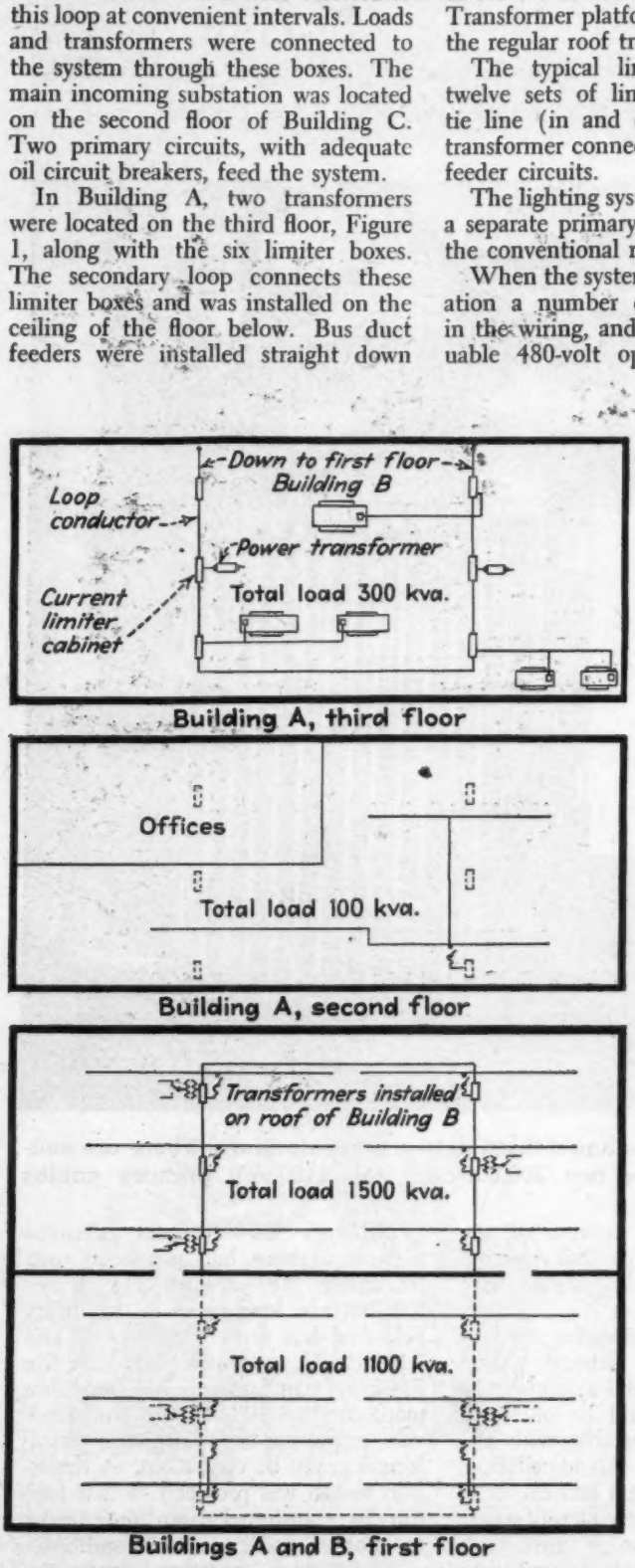


Figure 1. Original layout of the network distribution system, Buildings A and B, before adding Plant 2

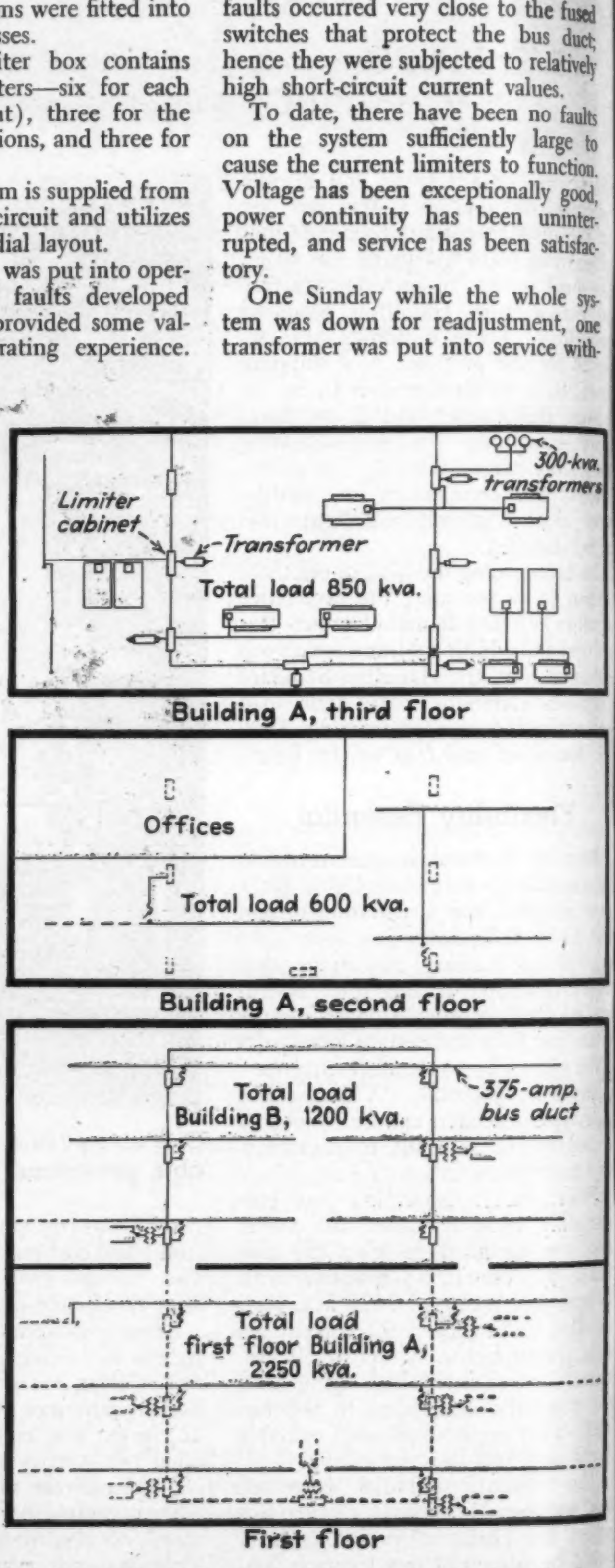


Figure 2. Final layout of the network distribution system, Buildings A and B, after adding Plant 2

out disconnecting the capacitors. Since under those circumstances there were 1620 kva. of capacitors connected to one 750-kva. transformer, the fuse in the network protector blew, interrupting the limited service that was being maintained. The workmen did not realize the current capacity of a large bank of capacitors. This instance served to indicate, however, that the transformer itself is protected adequately in case of an unusual overload condition.

Another time a transformer was thrown onto the network with the wrong phase sequence. The relay in the network protector did not allow it to close on this incorrect connection. Again, the system proved to be adequately protected against man failure.

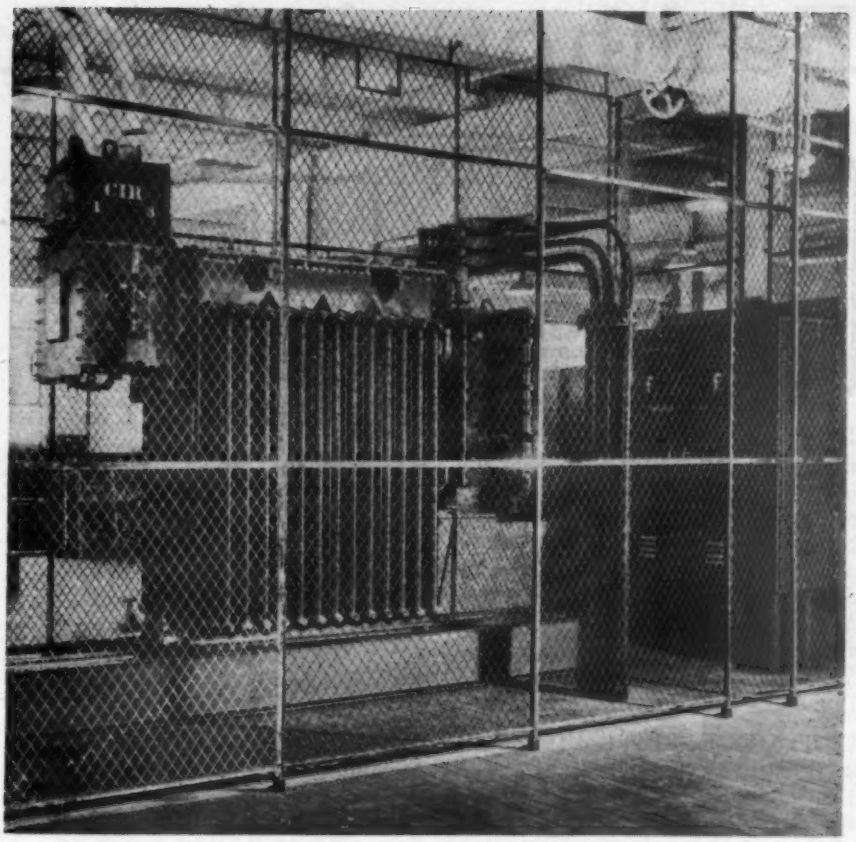
Before the first electrical system was completed, a second plant was set up to manufacture engine parts. This plant occupies a somewhat larger area than the original plant and was to have a 6500-kw. load. Since the characteristics of the loads in the two plants were similar, a second network system was chosen. This selection provided the added advantage of having similar standby equipment serve for both plants. Ten 750-kva. transformers with three pairs of primary circuits were installed for Plant 2. In general, the layout (Figure 2) is similar to that of Plant 1, except that a much longer loop was necessary, due to the shape of the buildings. Also in Plant 2 the lighting circuits are supplied from the network system, since it was calculated that voltage variations would be small.

A Lowered Load

In Plant 2 subsequent changes in product manufacture reduced the total load from 6500 to approximately 5200 kva. This reduction affected the basic design of the electrical system very little and the load redistribution was easily taken care of. In the meantime, several increases in production were planned and the plant layout was changed to accommodate them. Nevertheless no radical changes in the electrical system were needed.

Eventually it became necessary to combine the two plants. This change reduced the load in Plant 2 from 5200 to 3300 kw. and increased that in Plant 1 from 3300 to 4900 kw. Moving two transformers from Plant 2 and installing them on existing limiters in Plant 1, adequately provided for the new conditions. In addition, one primary circuit was transferred from Plant 2 to Plant 1.

In order to handle the load in case of a transformer failure, one of the transformers in Plant 1 was moved from the roof of Building B to the third floor of Building A. This move was advisable largely because of the shifting of a large portion of the load from Building B to Building A. The load consisted of a high concentration of ventilation equipment on the third floor of Building A.



Complete cage-enclosed 750-kva. network substation. Primary cables are at left, secondary cables and limiter cabinet at right, of transformer

When it came time to move this transformer it was merely necessary to deenergize one primary feeder, after the load had been transferred to the others, and disconnect the primary lines to the transformer. It was then possible to disconnect the limiters "hot." This operation was by no means difficult or dangerous. To reconnect the transformer the procedure was reversed. No interruption of service resulted.

In altering the layout of the plant, minimum expense was incurred, since practically all the material was available. The small amount of new material required was not strategic and therefore was easily obtained.

Before completing plans for the general rearrangement of the plant, the circuit for Plant 1 was set up on a calculating board. Although the load taken from the loop was very uneven, it was found that loading of the transformers was practically the same. Hence an overload at one location was equally divided among all transformers because of the relatively short loop, approximately 1500 feet. Since such conditions require equipment of high current-interrupting capacity, short-circuit current values were checked and found to be just under 50,000 amperes, and within the rating of the limiters. With the present length of loop it is, of course, impossible to install more transformer capacity. If more transformer capacity is necessary, a longer loop will be installed to accommodate the new load.

At Plant 2, a much longer loop existed (approximately 2500 feet) and when the two transformers were removed it was found impracticable to remove more because enough power would not be available to blow a limiter, should a fault occur. Therefore, in this case, the lower power limit has been reached unless some of the loop is removed.

In actual operation, the product being made has been changed, production has been increased, and the entire plant layout has been revamped several times. In each instance the electrical load was changed either in location or amount, but all this was accomplished with only one change in the electrical system, which is a tribute to its flexibility.

Health and Safety Equipment

Health and safety equipment introduced to you by *Factory* during the past 12 months is reviewed here to give you a quick one-year summary

BREAST PROTECTORS—Saf-t-Bra is designed to protect women in industry where operations present danger of breast injuries. Made of lightweight plastic material which can be easily cleaned, it is ventilated, and shaped to fit the curvature of the body. Available in small, medium, and large sizes. Willson Products, Inc., Reading, Pa. (Figure 1)

CARTRIDGE RESPIRATOR—Colored plastic chemical cartridges make this respirator a protection against sprays, fumes, and smokes. The color of the cartridge indicates the content of the cartridge and the uses to which it may be put. Facepiece is of molded rubber, and cartridges are readily changeable. H. S. Cover, South Bend, Ind. (Figure 2)

COLD MEDICAMENT—Iodo-lin preparation is claimed to abort the early symptoms of a cold, and to give relief in sinus conditions. Treatment is practically painless and does not involve taking worker away from job. Iodo-lin is available in 30- and 60-cc. vials. Lincoln Laboratories, Inc., Industrial Division, Decatur 32, Ill.

EYESHIELD—A non-fogging eye protection, Skullgard-Eyeshield is claimed to be easily attached to safety head gear. Transparent, plastic shield is hinged so that it can be positioned by a downward flip. When not in use, it lies flat against the cap. Mine Safety Appliances Company, Pittsburgh.

FINGERLESS GLOVE—Fingerless steel-reinforced glove of chrome-tanned cowhide is claimed to be practically rip-proof. A leather patch adds extra wear and protection on palm and junction of palm and thumb. Known as No. 14962. Industrial Gloves Company, Danville, Ill. **(Figure 3)**

GAS MASK—Respiratory protection in any atmosphere where there is sufficient oxygen to support life is claimed for the Protexall gas mask. Facepiece of molded rubber forms a gastight seal. Large shatterproof lenses, protected against fogging, are detachable. Noncollapsible corrugated tube allows free head movement. Cannister gives approximately 2 hours' service. American-LaFrance-Foamite Corporation, Elmira, N. Y. (Figure 4)

GOGGLES—Plastic spectacle-type goggles, fabricated from flame-resistant flat acetate stock, provide protection for flash and glare, and may be worn over regular spectacles. Side shields are optional. Temples may be adjusted easily for length and shape without heating. Frank E. Dodge & Company, Inc., Providence.

HEAVY-DUTY GLOVE FOR WOMEN handling rough, jagged materials. Made of chrome-tanned leather, reinforced on wearing surfaces with steel ribbons. Junction of palm and thumb has extra strength. Seams are sewed with steel thread. May be had in gauntlet style or with 2-in. wristband. Industrial Gloves Company, Danville, Ill. (Figure 5)

INDUSTRIAL GLOVES FOR WOMEN—Rubberized gloves for women workers supply hand protection against solvents, acids, chemicals, and caustics, it is claimed. Gloves are reinforced with a fabric lining that makes them snag- and tear-resistant. Two sizes, medium and large. Edmont Manufacturing Company, Coshocton, Ohio. (Figure 6)

MEDICAL CABINET—Prompt-Aid medical cabinet, which rolls on ball-bearing casters, is equipped with container for surgical tape, glass dressing jars, and solution bottles. The cabinet is built with four drawers and a two-door storage compartment. Working area is 42x17 inches. J. E. Erback Company, New York 1. (Figure 7)

MITTEN-GUARD FOR WELDERS—Made of heat-resistant leather, this guard, a mitten with open-end thumb, is slipped over the left-hand glove and provides protection against sparks and molten metal. Guard is readily slipped off after use. Industrial Gloves Company, Danville, Ill. (Figure 8)

PROTECTIVE CLOTHING—Made of a plasticized material, Durma-Gard

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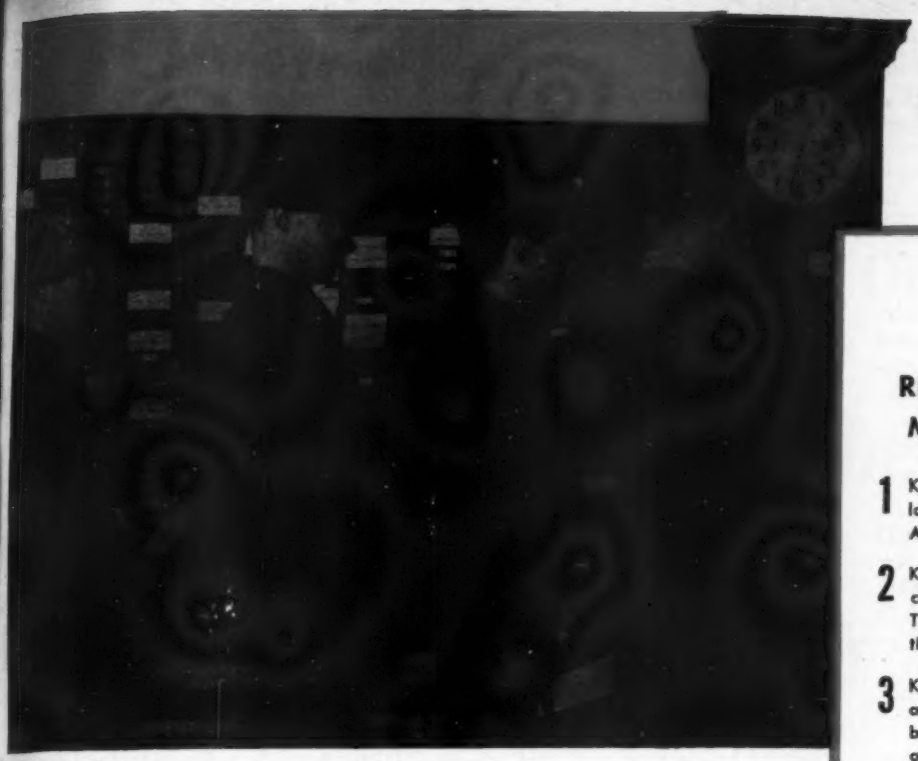

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SAVE TO WIN

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New workers soon learn to appreciate the compact efficiency found in Exide-Ironclad Batteries. Simplicity of operation, ease of maintenance, and rugged construction . . . all help to increase the efficiency of loading, unloading and load shifting of raw materials and packaged goods for our mighty production lines. Exide Batteries, long known for their durability and dependability, are essential to America's industrial war of movement.

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REMEMBER THESE EASY MAINTENANCE RULES:

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

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protective clothing is claimed flame-resistant, impervious to acids, and a protection against dust and other irritants. Garments, which can be worn over other clothing, have adjustable sleeves to fit the wrist, and can be washed in soap and water. West Disinfecting Company, Long Island City, N. Y. (Figure 9)

PROTECTIVE PRODUCTS—Welding curtains of flameproof, waterproof canvas or asbestos, canvas salvage covers, and asbestos fire blankets, made according to specifications, are equipped with eyelets to permit hook or cord suspension. Industrial Products Company, Philadelphia.

PROTECTIVE SOAP AND CREAM—Liquid Ordnance Soap No. 8 is claimed to guard the worker against dermatitis caused by tetryl or TNT. Protective Cream No. 99 is an external protection against these irritants. West Disinfecting Company, Long Island City, N. Y.

RESPIRATOR—All-plastic respirator, known as the Clear-Vue Model Dustfoe, is claimed to be durable, odorless, non-corrosive, and a non-conductor of electricity and heat. Unit gives protection against toxic dusts. All parts are interchangeable, and can be washed and sterilized. Mine Safety Appliances Company, Pittsburgh. (Figure 10)

SAFETY CLOTHING—Sta-Safe Eyemask is available in one-piece, all-plastic design that provides ventilation through perforations. Maker claims it is impact-resistant, lightweight, and non-flammable. A companion accessory, Sta-Safe Hairguard No. 18, is designed to cover the hair, has a visor that acts as a bumper. Standard Safety Equipment Company, Chicago 10.

SAFETY GAUNTLET—Grain leather is used in Steel Grip Safeguard gauntlet. Steel ribbons are placed diagonally for protection against cutting edges. Entire palm is reinforced with leather. Thumb is strapped for extra service. All closing seams are stitched with steel thread. Industrial Gloves Company, Danville, Ill. (Figure 11)

SAFETY HELMETS FOR WOMEN—"Protector" helmets for women in the plant are molded from vulcanized fiber into a one-piece, seamless crown. An adjustable chin strap holds the helmet in place. Available in small and medium head sizes. Strauss Company, Pittsburgh.

SKIN PROTECTION—Cadet Creme is offered for protection of skin against welding flashes and photo-sensitizing actions of certain heavy petroleum distillates. It is stated to contain no irritant chemicals, and not to retard normal perspiration. Cadet Creme Company, Worcester 5, Mass.

SKIN PROTECTOR—"Neo-film" comes in liquid form, and dries quickly into an elastic "invisible glove." Oil-proof and antiseptic, one application is said to be sufficient for the work period. Washes off with soap and water. Jones Medical Laboratories, Cleveland.

SKIN PROTECTOR—"Formula 1–43" is claimed to form a barrier against skin absorption of water, oil, or grease-carried irritants, and guard against fumes, scale, dust, paint, iron oxide, and other skin poisoners. Does not dry or chap the skin. AleXitE Engineering Company, Colorado Springs.

SKIN PROTECTOR—"CSC Protector" for industrial uses eliminates permanent griming. It is non-sticky, white, and greaseless. Manufacturer states it will not irritate sensitive skin, has no drying effect, leaves no stains, and is easily washed off. Commercial Solvents Corporation, New York 17.

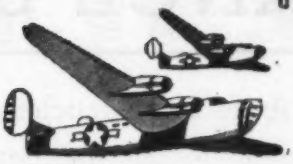
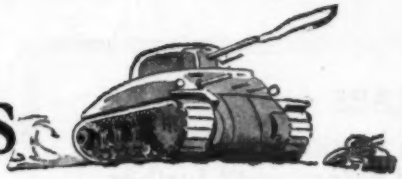
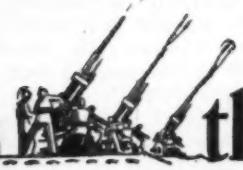
STRETCHER—Made of selected ash and cotton duck, the Stretcher-Kot is lightweight and easy to handle. The continuous rail allows the unit to be picked up from any position. Specially constructed 8-in. high legs turn it into a cot when it is on the floor. The fabric piece is removable for laundering. J. L. Schilling Sales Co., 16 E. 40th St., New York. (Figure 12)

VENTILATOR FOR WELDERS' HELMETS—Known as Cleanaire eliminates danger of poisoning by galvanizing fumes and banishes smoke inside the helmet. By a scientific formula an even flow of fresh air is introduced without draft on welder's face or head. Easily attached, weighs 3½ ounces. W. H. Kitchen Company, Seattle. (Figure 13)

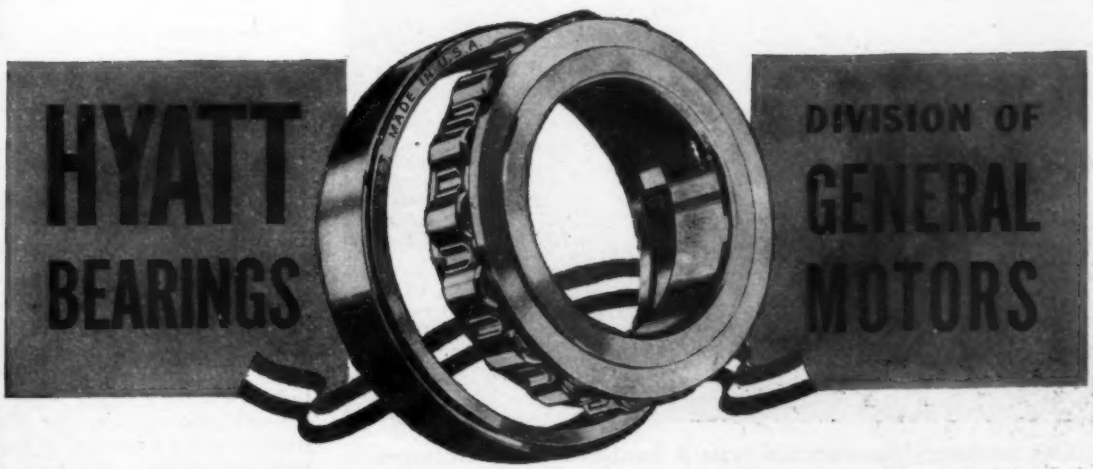
WELDERS' SAFETY GOGGLES—Noviweld-Didymium safety goggle lenses are said to cut down the sodium rays of the fluxes, thus enabling the welder to see through yellow flame and at the same time protecting his eyes from glare. Three shades of lenses are available. American Optical Company, Southbridge, Mass. (Figure 14)

WELDING SHIELD—"Huntsman" acetylene and arc welding shield is held in the correct position by a locking device, which assures that the line of vision passes through the lens at right angles to the surface of the glass. Shield can be lowered into working position by a nod of the head. Available in six models, weight ranges from 1 to 1½ pounds. Davis Emergency Equipment Corporation, Newark, N. J. (Figure 15)

WOMEN'S PROTECTIVE HATS—Guardi-Ann hat has a shaped crown and visor of all-wool felt, and an attached rayon snood to keep all the hair tucked out of harm's way. An air-cooled model has ventilated crown. Comes in eleven colors. Industrial Products Company, Philadelphia 33.

All of Hyatt's Production now goes into planes  our men fly ...into tanks  they drive... into ships they sail... into guns  they man... into equipment they need to win.

HYATT ROLLER BEARINGS SERVE SILENTLY, ACCURATELY, EFFORTLESSLY WHEREVER GEARS, SHAFTS, AND WHEELS TURN



HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

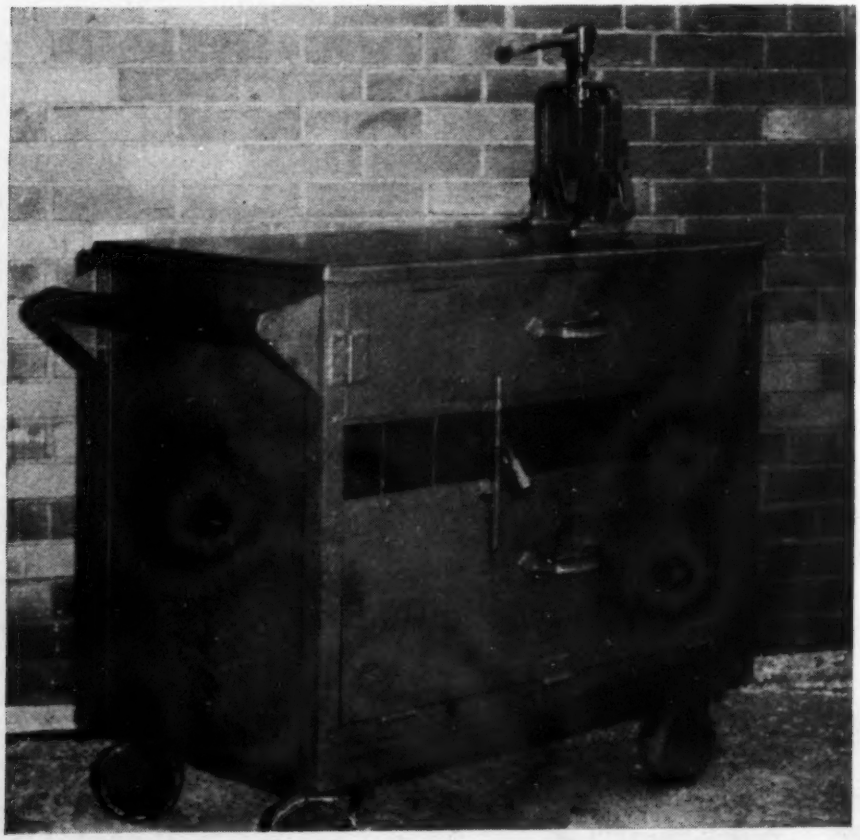
FIFTY DOLLARS

Will be paid for the best Maintenance Short published in each issue of *Factory* until further notice. (Do not submit Shorts that deal with production processes.)

All other Shorts accepted for publication will be paid for at attractive rates.

Contributors may submit as many items as they wish. Mail yours today!

Prize-winning short this month, "Regular Check Prevents Overheating," on page 162



Truck with all necessary maintenance tools is furnished to the craftsmen in the Eli Lilly maintenance department. Each man signs a statement, saying that he has received the truck and tools in good condition. No more reason for spending time running back and forth between job and toolroom

Tool Truck Cuts Maintenance Job Time

J. C. SIEGESMUND, Assistant Director of Engineering, Eli Lilly & Company, Indianapolis

Too often it is necessary for a maintenance man to return from any one of the four corners of his plant to the maintenance toolroom for equipment he did not know he would need when he started the job.

Electricians and pipefitters of Eli Lilly & Company, Indianapolis, are provided with portable shop trucks that are miniature toolrooms on wheels. They are used by construction men as well as by troubleshooters.

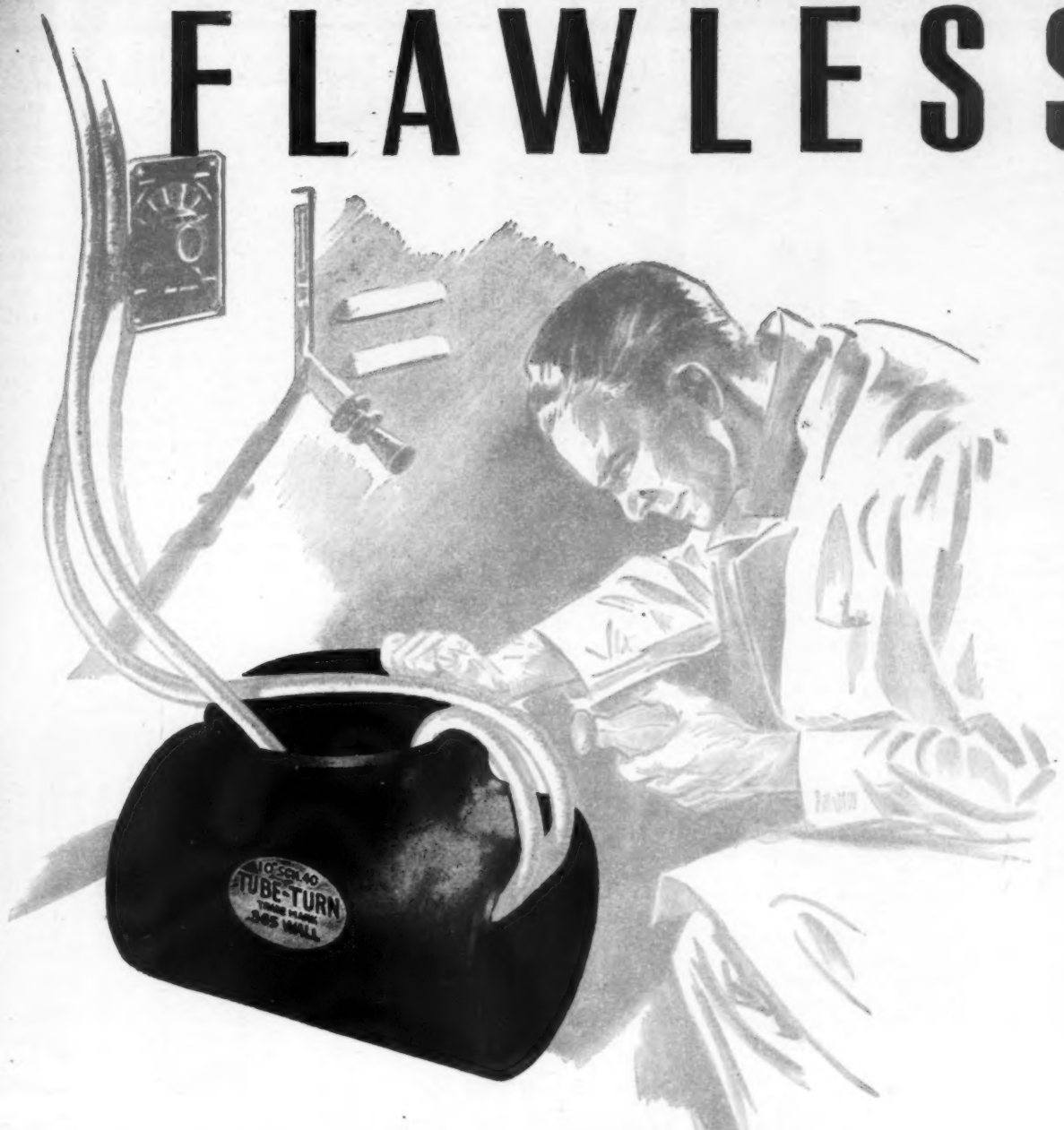
The truck equipped for a pipefitter, for instance, carries all the necessary tools to cut, thread, and work all pipe ranging in size from $\frac{1}{8}$ to 2 inches. The tools carried in such a maintenance truck are listed as follows:

1 each	—8-, 10-, 14-, 18-, 24-in. pipe wrenches
1 each	—8-, 12-in. monkey wrenches (wood handle)
1 each	—8-, 10-in. adjustable "S" wrenches
1	—10-in. solid-frame hacksaw
1	—combination nest, keyhole saw
1	—$\frac{1}{8}$- to 1-in. pipe die stock and dies
1	—1- to 2-in. pipe die stock (ratchet type) and dies
1	—pipe cutter
1	—pipe reamer
1	—1$\frac{1}{2}$-lb. machinists' ball pein hammer
2	—$\frac{3}{4}$-in. cold chisels
1	—$\frac{3}{8}$-in. round nose chisel
1	—center pinch
1	—plumb bob
1	—spirit level
1 each	—8-, 12-in. screwdrivers
1	—pliers
1	—dividers
1	—1-pt. oil can, copperized steel
1	—ratchet bit brace
1 each	—$\frac{3}{8}$-, $\frac{5}{8}$-, $\frac{3}{4}$-, $\frac{7}{8}$-, 1$\frac{1}{8}$-in. wood bits
1	—pipe vise, size $\frac{1}{8}$- to 2-in.
1	—vaporproof extension light

The truck, completely equipped, is furnished by the company to each craftsman, who signs a statement that he has received the truck and tools in good condition. He is also provided with a lock to keep the truck locked when not in use.

Every two months the truck is inspected by the supervisor of the respective shop for lost tools, bad tools, cleanliness, and orderliness. It is gratifying to note that few tools have been lost. All lost, worn, and defective tools are immediately

FLAWLESS



THE MAGNAFLUX TEST, shown above in Tube Turns' laboratory, quickly reveals any hidden defects in the finished product.

Flawless **welding fittings are even more essential than perfect pipe. For extreme velocities, high pressures, vibration, strain, corrosive wear are *most* destructive to piping systems where flow changes direction . . . *at the fittings!* Defective fittings can cause leakage, breakdowns, unnecessary maintenance and can disrupt imperative production schedules.**

Tests to *insure* flawless fittings have been, are today and will be a permanent Tube Turns' policy.

TUBE TURNS (Inc.) Louisville, Kentucky. ***Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle . . . Distributors located in all principal cities.***

ARMY E NAVY M

TUBE-TURN

TRADE MARK

Welding Fittings and Flanges

Magnetic scrap pick-up towed by a tractor makes the rounds of General Electric's parking fields and roads at Schenectady every Sunday, collecting scrap for the war effort. The magnetic pick-up consists of more than 75 percent scrap parts, including the gasoline mofor and generator. The only new parts made were the frame holding the machine and the magnet coils. Six feet wide, the magnet is powerful enough to pick up a manhole cover, but the operator prevents this by de-energizing the magnet when passing over them. It easily pulls out nails, tacks, or bits of wire from the surface of the parking field and factory roadways, which also saves tires

replaced. No penalty is assessed for lost or broken tools.

The use of these trucks has also improved the safety record. Improper and makeshift tools, as well as worn and broken hand tools, are likely to cause lost-time injuries.

The cost of one of these trucks equipped was about $150, depending upon the number of tools supplied. During the time that the trucks have been in use, their cost has been justified by reduction of job time and more efficient service.

•

Regular Check Prevents Overheating

RALPH MORIN, Chief Electrician, Boston Gear Works, Inc., North Quincy, Mass.

We used to have considerable trouble caused by overheating of vital parts of our wiring system, such as fuses, switch contacts, lugs, and so on. When we started working three shifts, the danger of failure was greater, because when a part started to heat, the temperature kept going up, due to continuous operation.

We procured a thermo-couple type temperature indicator, insulated everything but the tip, and then systematically checked every contact point of over 30-amp. capacity. Our first check uncovered several "hot" spots, which were corrected during the lunch period.

We now do this weekly by chart. Sometimes we go as long as three weeks before we uncover a spot that is overheating. Other times, we find as many as five "hot" points on one set of tests. Once every three months, we check temperature of fuses in the panels supplying branch power circuits.

We feel that the time put into this temperature checking has been well spent, because we haven't had any burn-ups in panels since the program was started two years ago. This check is becoming increasingly important, because the equipment is not up to the standard we purchased a few years ago.

•

Simple Cutter for Washer-Type Gaskets

ROBERT S. ALEXANDER, Newport, R. I.

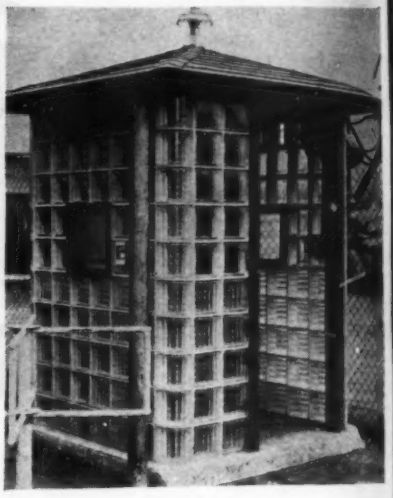
In maintenance work we have occasion to use gaskets of the washer type in varying sizes of outside and inside diameter. The material used is an asbestos fabric $\frac{1}{16}$ to $\frac{3}{32}$ inch thick.

This fabric comes in sheets, and the washers or gaskets are cut from the sheet by means of the cutter shown in the sketch. As will be seen, the cutters, which are made from drill rod hardened and ground, are held by recessed head setscrews in a holder made from square, cold-rolled steel. The center stud was also turned from drill rod and hardened to reduce wear.

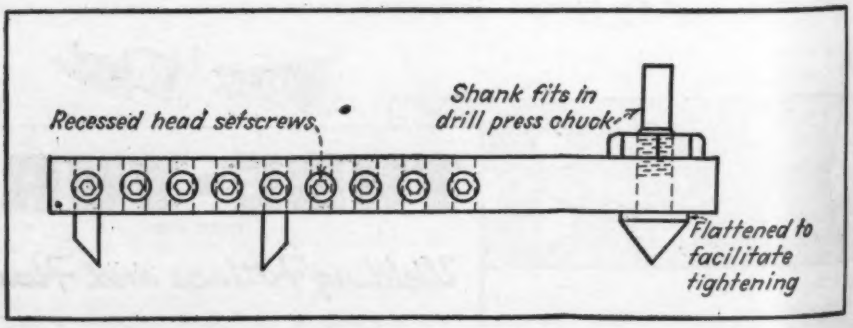
In operation, the shank of the center stud is held in the drill press chuck and the drill press is rotated at slow speed, or by hand, if belt driven. The material to be cut is placed on a flat board on the drill press table and positioned by a thumb tack near the center so that the cutting action will not cause the sheet to move. Slight pressure on the drill press handle will result in a cleanly cut gasket being formed, the inside and outside diameters being determined by the setting of the cutters and the center swing or radius. Cutter holes are positioned to suit the most popular gasket sizes, which in our case range from 4 to 12 inches outside diameter.

We have used this cutter successfully in cutting thin metal shim, the cutters being suitably ground for that purpose.

•



Non-transparent, light-diffusing glass blocks form the lower half of this gatehouse, while inserted panels of clear blocks in the upper half give the watchman clear vision in every direction. The roof is of fire-resistant asphalt shingles. Equipped with electric lights and telephone, it serves as a control station for guard activities 24 hours a day. A small electric heater keeps it warm in winter



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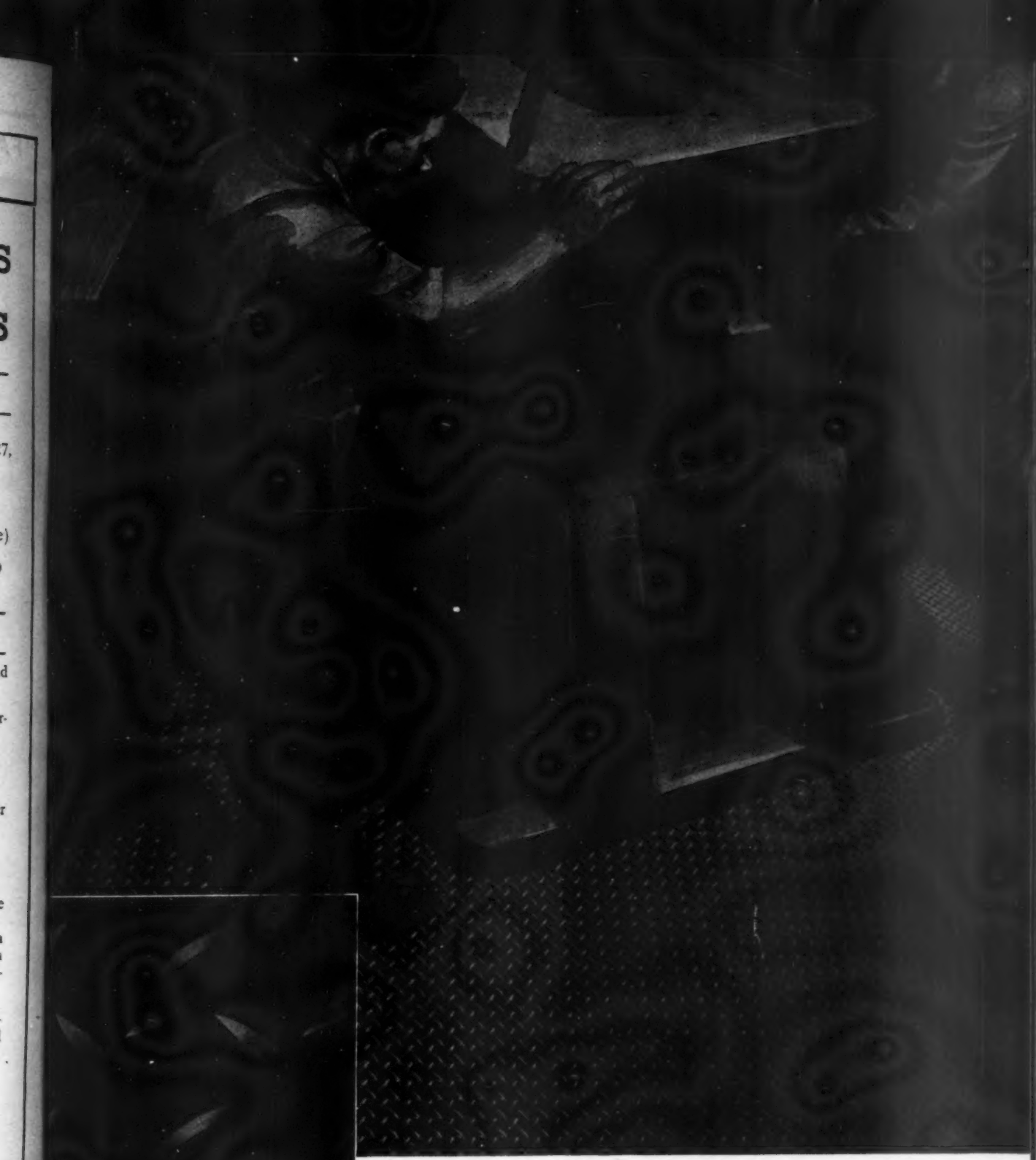
Scales

Common Carbon-Brush Troubles of D.C. Generators and Motors

Symptoms	Possible Troubles	Symptoms	Possible Troubles
Arcing and flashing between brushes and commutator	Items 1 to 19, 21, 27, 28, 29 (a)(b)(e) 30	Brushes picking up copper	Items 1 to 4, 29 (b)
Rings of fire around commutator	Items 16, 17, 18, 20	Rapid brush wear	Items 7, 9, 11, 21, 22, 27, 28 (a)(b)(c), 30
Singing brushes	Items 22, 23, 29 (d)(f)	Loosening of brush shunts	Items 2, 3, 21, 28, 29 (c)
Chattering of brushes	Items 7, 8, 9, 10, 11, 21, 24, 25, 26, 29 (d)	Bright raw commutator, indicating rapid wear	Items 22, 29 (f)
Glowing of brushes, and pitting of brush faces	Items 1, 3, 4, 21, 27 28, 29 (b)(c)	Black commutator	Items 11, 27, 29 (b)(c)(e)
		Flat spots on commutator	Items 7, 9, 10, 11
		Heating of commutator	Items 1 to 4, 7, 22, 27, 29
		Motor fails to start	Items 2, 5, 30

Trouble	Cause	Remedy
1. Brushes not on electrical neutral	Setscrew holding rocker arm may be loose	Shift rocker arm and brushes to neutral point, and tighten setscrew
2. Brushes not diametrically opposite	Brush-holder studs are loose, or not properly set	Adjust brushes on diametrically opposite bars by measuring with tape, or counting commutator segments
3. Brushes not parallel to commutator bars	Brush holders not set properly on studs	Adjust holders to line up properly
4. One or more brushes in contact with too many commutator bars	Brushes too thick	Use thinner brushes, or notch those in use to proper thickness
5. Brushes too short	Wear	Provide new brushes
6. Poor contact between brush and commutator	(a) Oil or grit on commutator (b) Brushes improperly trimmed (c) Flint or other hard substance in brush	(a) Clean commutator with soft dry rag. Never use waste (b) Place a piece of sandpaper under brush, with smooth side towards commutator, and work back and forth (c) Sandpaper the brush to remove foreign matter, preserving curvature of commutator
7. Rough commutator	(a) Vibration (b) Hardness difference (c) Uneven brushes (d) Uneven ridges on commutator	(a)(b)(c)(d) True the commutator with a commutator stone or piece of sandpaper, being careful to clean all copper dust from commutator afterwards
8. Loose bars	Clamping cone and jam nuts are loose	Tighten cone and jam nuts, and true commutator by turning even in a lathe
9. High bars	Clamping cone and jam nuts are loose	Carefully drive high (bright) bars back into place, and tighten cones and jam nuts. Smooth commutator
10. Low bars	Rough handling, or wearing away due to soft bars or from a short-circuited coil	Loosen jam nuts and cones, lift low bars even with others, tighten jam nuts and cones, and true commutator with stone. If this is not effective, lathe truing is necessary
11. High mica	(a) Copper is worn faster than mica (b) Brushes are too soft	(a) Undercut mica below surface of bars, and remove all dust. Keep mica stoned down (b) Consult manufacturer regarding suitable brushes
12. Grooving, ridging	(a) Brushes fail to cover entire longitudinal surface of commutator	(a) Remove ridges and grooves by commutator stone, or by truing on lathe if necessary. Stagger pairs (not alternate) of brush studs so that successive poles of opposite polarity follow same track
	(b) Dirt and grit become lodged in brush surface	(b) Remove ridges and grooves as above, and sandpaper the brushes to remove foreign matter

(*Continued on page 166*)



It's the "little" things . . . The successful completion of today's *big* war projects depend on "little" things . . . Like rugged floors that withstand punishing hours of wear . . . Safe floors that prevent costly falling accidents. "A.W." Rolled Steel Floor Plate can be cut and installed almost overnight without disturbing production. Illustrated is the "A.W." Super-Diamond Pattern which resists slipping in *any* direction. Oil-proof, heat-proof, fire-proof, crack-proof. Write for folder.

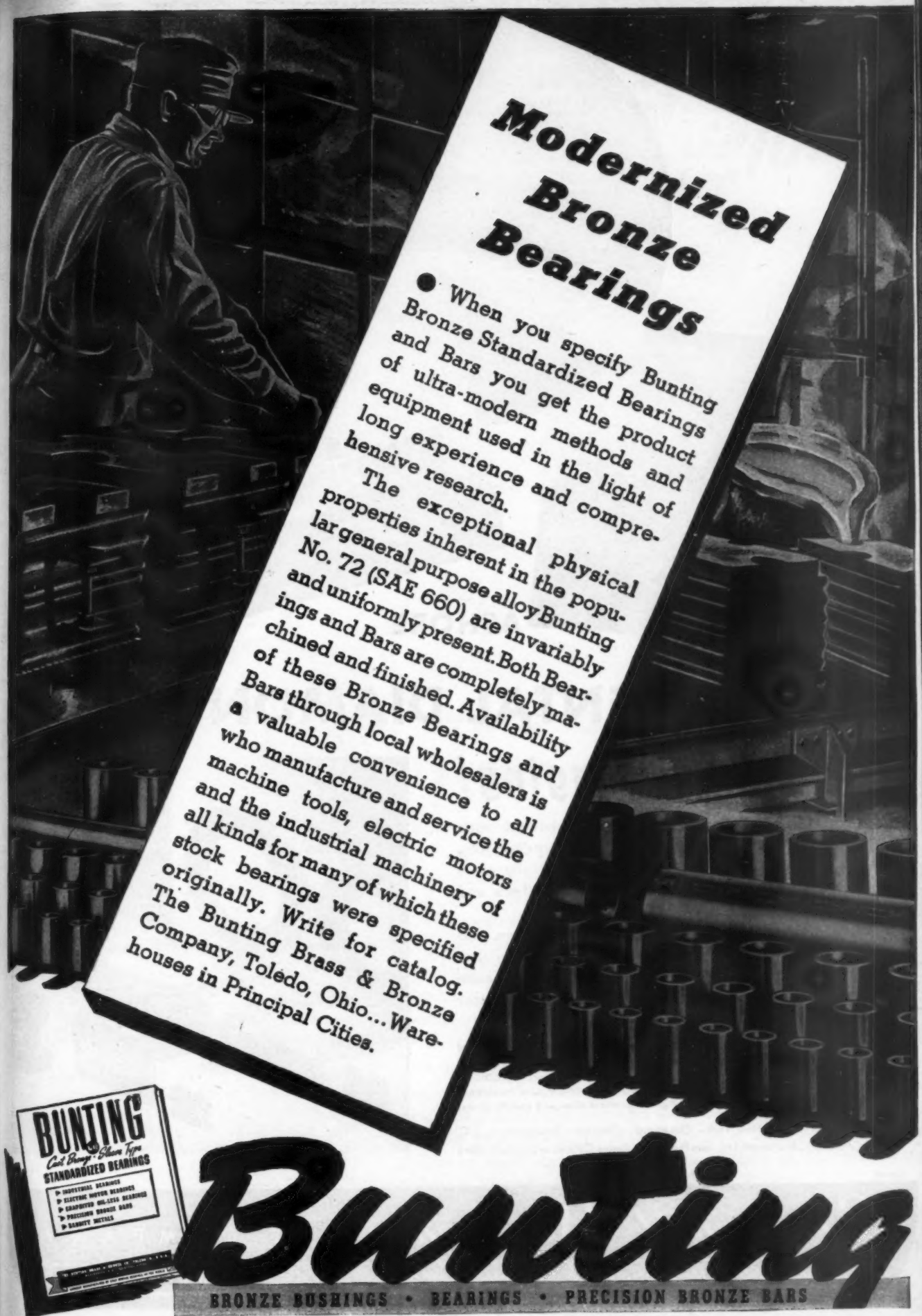
Other products include Plates, Sheets, Billets, Blooms, Slabs—Carbon, Copper or Alloy analyses.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Sanford, N. C., St. Louis, Los Angeles, San Francisco, Seattle, Montreal

Common Carbon-Brush Troubles *(Continued from page 164)*

TROUBLE	CAUSE	REMEDY
13. Commutator bars short-circuited, mica worn or broken away, causing deep pits between bars	(a) Carbon or copper dust between bars (b) Melted solder from leads between bars	(a)(b) Remove dust or solder from commutator slots
14. Ground on machine line	Defective insulation	Remove ground if possible, or cut out grounded coil, or rewind grounded part
15. Excessive current in armature	(a) Motor overloaded (b) Wrong type controller for motor (c) Generator overloaded	(a) Reduce mechanical load (b) Replace with proper type controller, having correct resistance for armature current (c) Reduce electrical load
16. Short circuit in armature of motor	Defective insulation	Cut out short-circuited coil and bridge adjacent commutator bars, until permanent repairs can be made
17. Short circuit in armature of generator	Defective insulation	Repair, or rewind, as necessary
18. Open-circuited armature coil	(a) Conductor burned by short circuit (b) Connection at commutator bar is poor	(a) Bridge the open circuit by connecting commutator bars adjacent to break, until repairs can be made (b) Clean and resolder connection
19. Reversed armature coils	Cross connection made to wrong commutator bars	Test polarity by use of compass, and connect to proper bars
20. Carbon dust or copper particles lodged in commutator slots or in broken mica	Wear, or application of too much lubricant	Clean out cavities, or undercut mica
21. Worn brush holders, providing only "line" contact with brushes	Mechanical wear	Replace all worn holders
22. Brush pressure too high	Improper adjustment of brush-holder springs	Reduce part of tension of brush-holder springs. Use small spring balance, and adjust to give pressure recommended by manufacturer
23. Brushes too hard		Replace with softer brushes. Consult manufacturer
24. Brush set at wrong angle for rotation.	Friction pressure overcomes brush pressure	Change grade of brush or angle of operation. Consult manufacturer as to the better remedy
25. Too much clearance between holder and commutator	Increased mechanical tendency to vibrate	Reduce clearance to $\frac{1}{8}$ to $\frac{1}{4}$ inch by trial for best results
26. High ridges on commutator	Not enough end play in commutator shaft	Remove ridges with commutator stone. Adjust shaft end play, by resetting shaft collars
27. Brush pressure too low	(a) Brush spring too weak or de-tempered (b) Poor adjustment	(a)(b) Consult manufacturer for correct pressure. Adjust brush spring or replace with new one, being sure to equalize all brush pressures by use of spring balance
28. Unequal brush pressure, causing unequal load distribution	Brush springs improperly adjusted	Equalize to proper brush pressures by adjustment of brush springs, using spring balance to obtain uniformity
29. Wrong grade of brush	(a) Too high contact drop (b) Too low drop (c) Too low capacity (d) High friction brush (e) Too little abrasive action (f) Too much abrasive action	(a)(b)(c)(d)(e)(f) Consult manufacturer as to proper grade of brush to be used. Before installing new brushes, true commutator surface with stone and clean off dust
30. Brushes not in continuous contact with commutator	(a) Brushes fit too tightly (b) Brushes or holders are dirty (c) Brush-holders are burned due to undersized or loose shunts	(a) Adjust brushes to work freely in holders (b) Clean brushes or holders (c) Remove rough spots in holders, provide shunts of sufficient capacity, and attach them to brushes by approved method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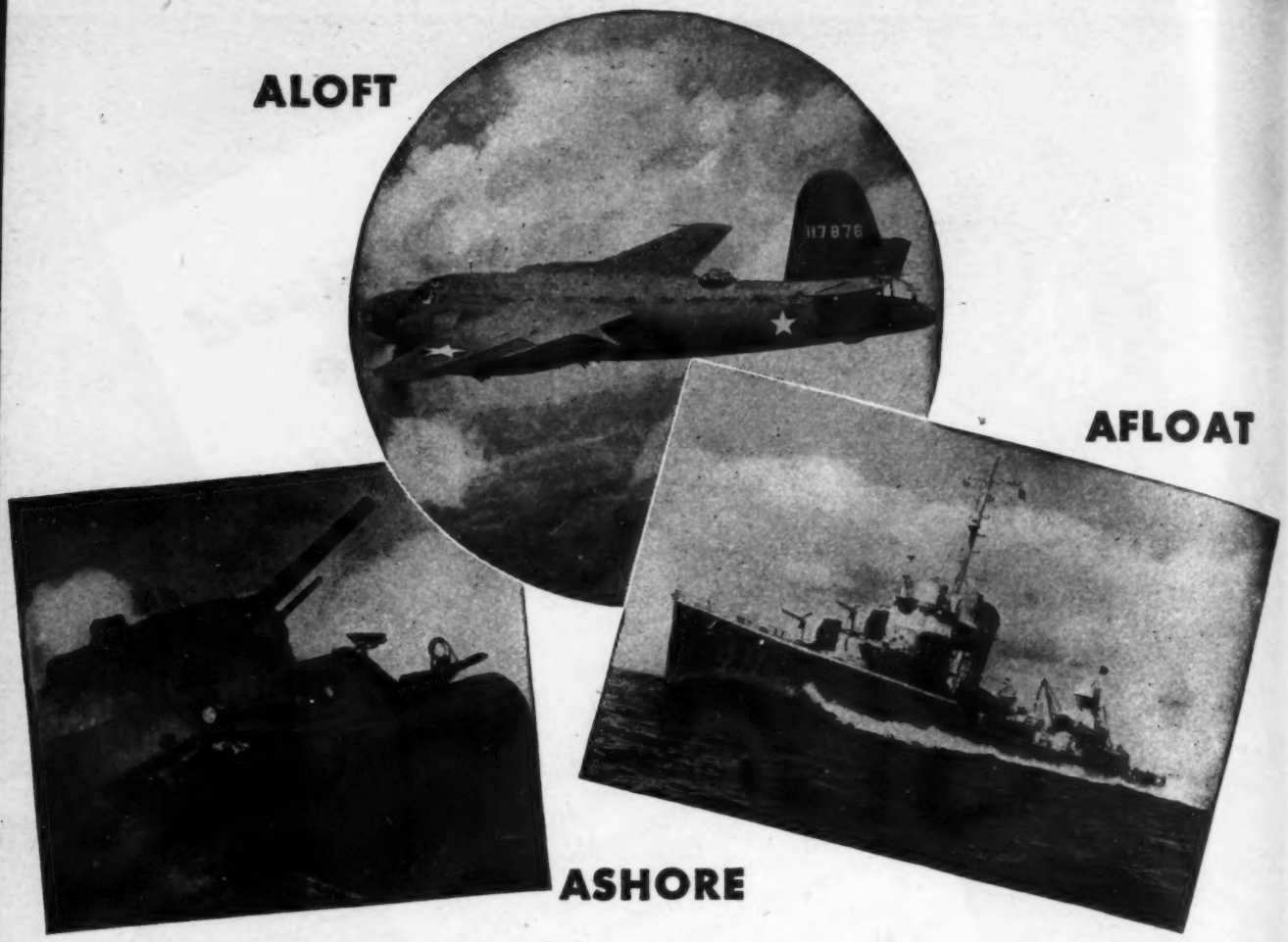

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C-D makes hundreds of electrical and mechanical parts which are vital to the successful operation of radios, guns, controls, communication systems, and all electrically energized units in our fighting equipment afloat, ashore and aloft.

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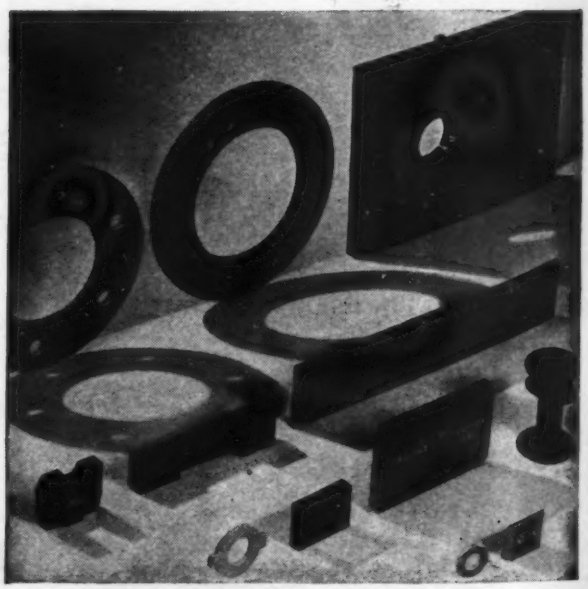

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THIS GEARMOTOR IS DESIGNED FOR IT!

Your postwar conversion may mean shifting motors and machines to new locations. New locations may require different type motors—open, totally-enclosed, splashproof or explosion-proof. But whatever your postwar need, the versatile new line of Westinghouse Gearmotors is designed to meet it. Standard Westinghouse motors of all types in the installed frame size are *interchangeable* on the gear frame.

This complete interchangeability of motor types means *flexible* slow-speed drives that can be modified when conditions change—easily, economically and quickly.

There is a multitude of additional design features in the new Westinghouse Gearmotor. It is available in ratings from 1 to 75 hp with standard AGMA output speeds. For complete information, write for new application Bulletin 3218, a 20-page handbook of gearmotor applications. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-07214

IMPROVED FOUNDATION STABILITY

Feet for all new Westinghouse Gearmotors are under the gear case . . . placing support next to gearmotor load. External ribs reinforce *each* gearmotor foot.

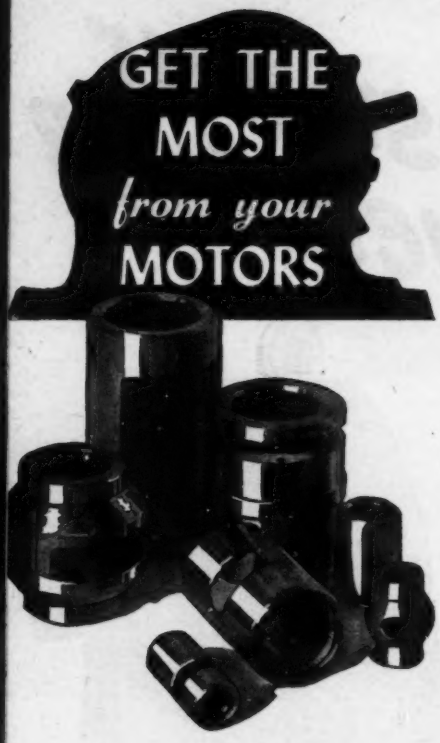
FLUSH MOUNTING SAVES SPACE

New Westinghouse Gearmotors are extremely compact. No part of the gear housing projects beyond the line of the mounting feet. This permits fitting gearmotor tightly against driven machine.

MEETS STANDARD CLASSES OF SERVICE

New Westinghouse Gearmotors are designed to meet AGMA Standard Application Practice . . . making it easy to order and match gearmotors to *any* job.

Westinghouse PLANTS IN 25 CITIES... OFFICES EVERYWHERE **GEARMOTORS**



Install

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Leaded Bronze

BEARINGS

How many "lazy" motors in your shop? Before you blame the equipment . . . check up on the bearings. In order to get maximum power from each unit, it is necessary to install bearings that are designed to *assist* the motor . . . not retard it.

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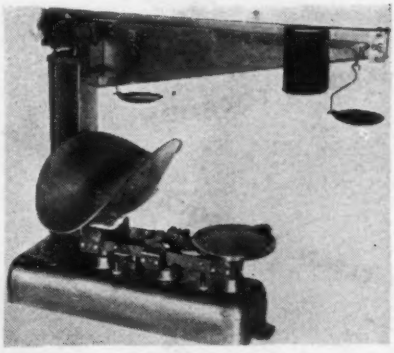
WHAT'S NEW IN EQUIPMENT

Counting Scale

Detecto-Gram model No. 66-02 industrial scale was specially designed to count very small, light pieces speedily and accurately. It has a sensitivity of 1/64 ounce and is



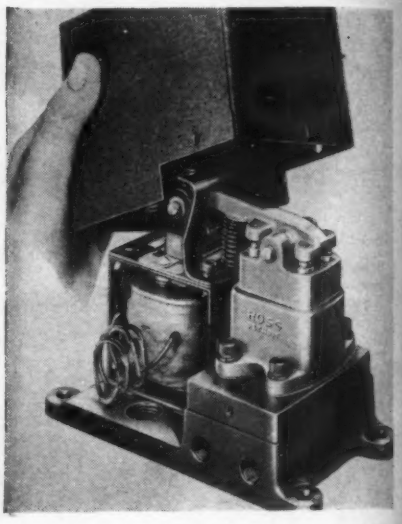
equipped with an "over-and-under" dial that shows up a discrepancy of one piece more or less than the desired count. The two counting pans are arranged on a 10:1 and 50:1 ratio. Capacity of scale is 6 pounds. Detecto Scales, Inc., 6 Main St., Brooklyn 1, N. Y.

Blast Fan

The "Air Blaster" is claimed to deliver a large volume of air in a straight line to the spot where it is needed, because the discharge expands only slightly and continues as a high velocity air stream over large distances. In addition to securing ventilation of hot or cold occupational exposures, suggested applications include cooling of condensers, ammonia compressors, and transformers. Unit consists of a heavy-gage welded steel housing, mounted on an adjustable pedestal which may be tilted 60 degrees up or down. Fan blade is of heavy steel, die-cut, die-formed, and balanced; and is driven by a direct-connected ball-bearing motor. Unit is available in three sizes: 18 inches, 6000 c.f.m., ¾-hp. motor; 24 inches, 9000 c.f.m., 1½ hp. motor; 30 inches, 11,000 c.f.m., 1½-hp. motor. Chelsea Fan & Blower Co., Inc., 1206 Grove St., Irvington, N. J.

Air Control Valve

Model No. 835 midget air control valve has been designed for operation at sustained speeds up to as high as 400 reversals per minute. It is a heavy-duty, solenoid-operated 4-way valve for the control of double-acting cylinders, but may also be used as a 3-way valve by plugging one outlet. Valve works on poppet-type principle embodied in all previous models and is said to feature low current consumption, noiseless operation, and long life. Valve body is tapped for ¼-in. connections, and over-all dimensions are 7x3¼x5¼ inches. Ross Operating Valve Co., 6477 Epworth Blvd., Detroit 10.



Wool Sponge

Wool-Tex sponges, made from woolen cloth, are offered as a substitute for the hard-to-get natural sponge. They are shaped like a small pillow, size about 4½x5½ inches. Long-fibered cloth is said to absorb water quickly, to be soft when wet or dry, and of good lasting qualities. Wool-Tex Sponge Co., 368 E. 45th St., Brooklyn 3.

Bar-Stock Truck

Known as Model 6018, a balanced, four-wheel truck is announced for the specific purpose of handling bar stock. Because the nature of the load that it carries requires maneuverability, truck can be turned

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. . . Here's Why: Leather has the longest life of any known belting material. Leather Belts are seldom discarded because they are actually worn out to the point of being useless.

Your own pile of old Leather Belting is probably made up of belts that are still good but which were removed from their jobs because of changes in machines or drives . . . double belts with only one ply worn . . . belts with only a few bad spots . . . and short pieces. All of these can be put back to work by rebuilding . . . by cutting into narrower widths . . . cutting out bad spots . . . and splicing short pieces into a continuous belt.

Call in your belt supplier and ask him to look over your old belting for possible salvage and rebuilding.

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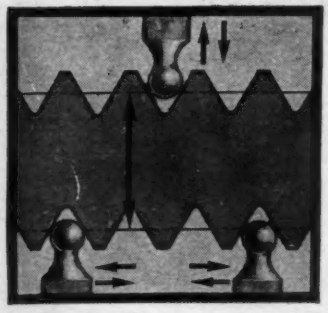
MODEL 45B-100. The upper, sensitive roller contact actuates the Dial Indicator.



MODEL 45B-80. The upper, sensitive ball contact actuates the Dial Indicator. Both lower ball anvils float sidewise independently to compensate for any variation in lead.

No conventional type of gage, whether ring gage or roller-type snap gage, can tell you so **definitely** and so **quickly** the degree of accuracy of a pitch diameter as these two types of Dial Indicator Gages. Neither depend upon the uncertain sense of touch.

The roller type tells more than the conventional roller snap gage because the sensitive upper roller contact, reveals on the Indicator, just **how much** and **where** the pitch diameter may be wrong. The ball type simulates the three-wire method, but is faster. It is accurate to a tenth of a thousandth. Either type is incorporated in the adjustable Dial Indicator Gage shown below. For details write—

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PRECISION MEASURING INSTRUMENTS

Dial Indicator Truism—

Gaging without **Dial Indicators** is like shooting without gun sights.

Put **Dial Indicators** on your gages and see where you are shooting.

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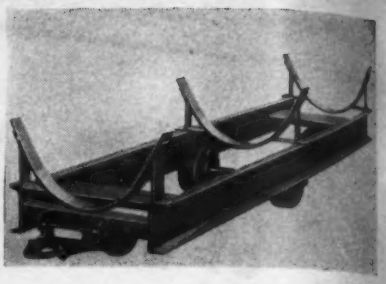
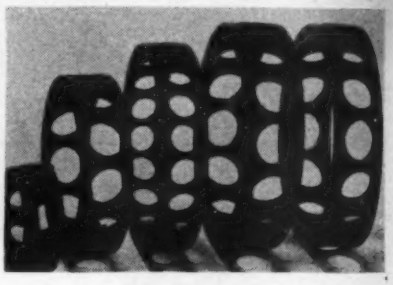


around in its own length like a turntable. It is furnished with two heavy-duty swivel casters front and rear, and two heavy-duty steel wheels, equipped with Hyatt roller bearings, on center axle. The frame is built up of electric welded structural steel members. Trailer coupling is located on the front. Rose Mfg. Co., 12400 Strathmoor, Detroit.

Plastic Ball-Bearing Retainer Rings

Plastic retainer rings for ball bearings are said to be particularly adaptable for use on high-speed grinders. Rings are made of micarta, a less critical material than steel or



bronze, and are stated to have great mechanical strength and lightness in weight. Rigidity of ring is combined with sufficient flexibility to resist vibration, fatigue, and shock. Because micarta claims good wetting qualities, lubricants are said to adhere better and provide quieter operation with less wear. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

File

To meet the need for high-speed filing of work pieces without reducing lathe speed a Kennametal file has been developed. It is said to cut steels of a hardness up to 62 Rockwell C, and to cut iron and brass at surface speeds around 900 feet per minute. Kennametal file is available in only one size, known as F76, which is 11 inches long by $\frac{3}{4}$ inch wide and $\frac{1}{8}$ inch thick. Filing surface is 4 inches long, made of grade K4H Kennametal (80.6 Rockwell C), single cut with teeth at 30-deg. shear angle, 40 per inch. Convenient grips are provided for operator's hands. Kennametal Inc., 130 Lloyd Ave., Latrobe, Pa.

Carbon Heating Coil

Graphitic carbon heating coil has been developed for steam heating of tanks containing acid cleaners, such as are used to prepare aluminum parts for spot welding. It is said to be impervious to chemical action, to be entirely non-metallic, and to

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Coat pocket "shipment" launched Navy boat

Rush Trip By Wesco Man For Electrical Pushbuttons Assured On-Time Christening.

The champagne bottle was be-ribboned and the compact Navy boat stood poised on the ways ready to slide into Massachusetts Bay. Suddenly it was discovered that pushbuttons, essential to the many electrical operations aboard the vessel, had never been ordered. After a thorough search of the vicinity verified that buttons of the right types and sizes were unobtainable, there was a confused halt in launching plans.

Arriving at the shipyard in answer to an urgent call, the Wesco man went into action; in a few minutes he was on a train speeding to New York. Early the next morning he was back in the yard, his coat pockets bulging with the pushbuttons —so little in size, so vital in importance. Thanks to Wesco's unconventional service the situation was saved and the launching took place as scheduled.

Wesco's uncanny ability to get things done in the face of obstacles and emergencies has speeded many a wartime job to early completion. Your present and postwar problems will be solved more easily if you employ the services Wesco can place at your disposal.

WESCO SPEEDS WAR PRODUCTION

* To start production, a powder plant required special floodlights. Best quoted delivery involved a paralyzing 14-week delay. Wesco contacted a manufacturer and delivered the "floods"—in only 10 days!
* A steel plant under construction required 18 items from 6 manufacturers. Wesco delivered the complete order in 3 days—averting a 9-month delay.

• • •

WESCO SERVES BUSINESS

* By providing trained sales and engineering personnel.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
* By assembling all parts of an order in one shipment.

GIVE YOUR BLOOD TO THE RED CROSS

Westinghouse Electric Supply Co.

150 VARICK STREET . . NEW YORK (13), N. Y.

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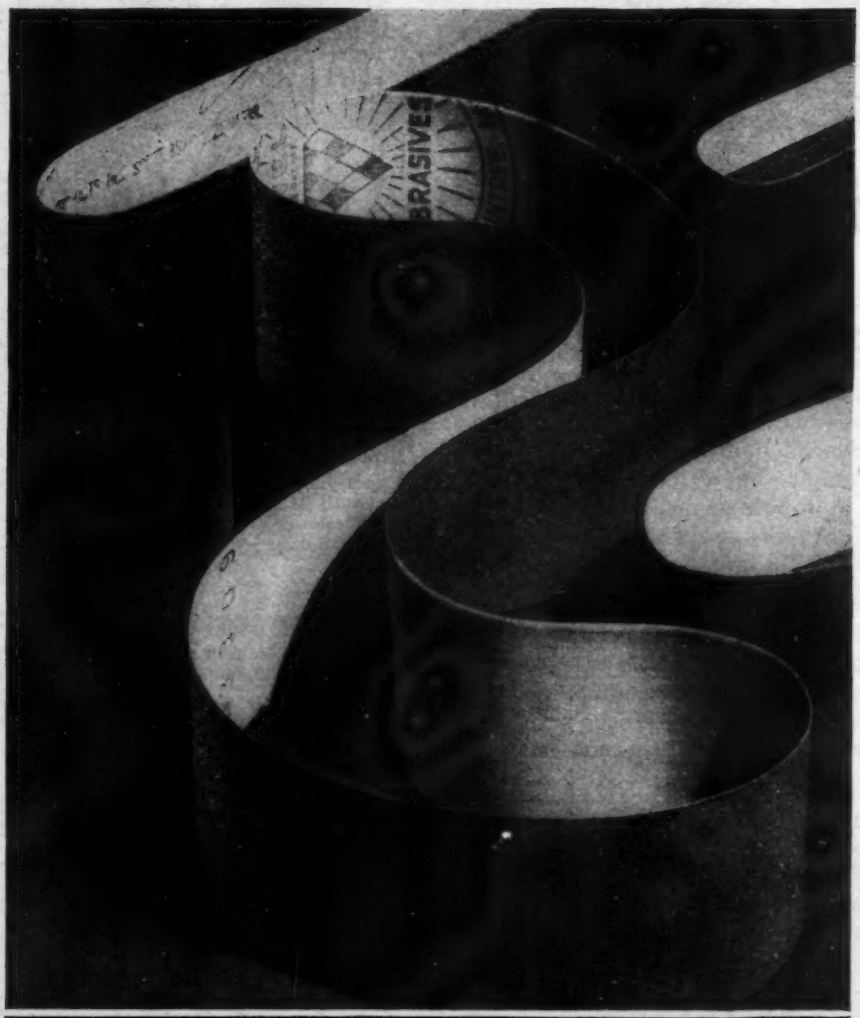
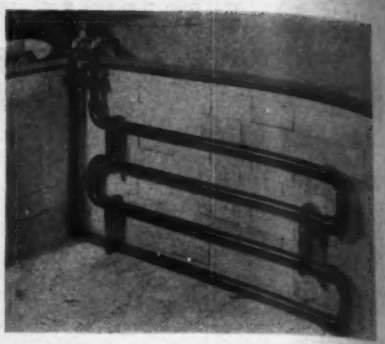
Tune in John Charles Thomas, NBC, Sundays, 2:30 P. M., E. W. T.

ABRASIVE BELTS...for any type of job, for every requirement . . . there's a standard or special type and grade in the large, complete Jewel Line. Users in all industries specify Jewel Abrasive Belts for cleaner surfaces, faster work . . and time and labor savings. No matter what your problem is..the proper use of Jewel Abrasive Belts will help you solve it. It will pay you to investigate.



Abrasive Products, Inc.

SOUTH BRAINTREE 85, MASSACHUSETTS · MAKERS OF JEWEL COATED ABRASIVES



have a heat conductivity between that of steel and copper. Because it is unaffected by many of the chemicals that attack metallic heating coils it can be used for heating pickling baths, electroplating and metal-etching baths, and for muriatic pickling and other chloride processes that now require heating for best results. Coil is made in standard sizes and in any shape for a wide variety of uses, and will withstand steam pressures up to 50 lb. per sq. in. Other heating equipment of the same material includes steam jets, bayonet-type heaters, nozzles, heater sheaths, and electric immersion heaters. Heil Engineering Co., 12901 Elmwood Ave., Cleveland.

Photographic Printer

Model 55C continuous photographic printer is announced, using semi-photographic reproduction processes. It is said to provide clear and faithful duplicates of anything typed, printed, photographed, or drawn. Requires only 40x62 inches floor space, and can be used inside or outside of darkroom, or moved about on caster mounting. Machine operates either with roll stock or cut sheets. Speeds up to 18 feet per minute, and special shutter exposure arrangments, are individually controlled. Twenty-two individual 2-in. bands around pyrex cylinder are said to hold originals and sensitive materials in register and to prevent blurred prints due to slippage. Ease and simplicity of operation are claimed by the incorporation of various features, such as the illuminated feed-board arrangement that places originals on top of print, reversing foot pedal, and large return tray across entire top of machine. Machine is wired for 100-volt a.c., 60 cycle, or 220-

"Near misses" will never win your battle for tomorrow's markets . . . you'll have to be right "on target".

That goes for your motor applications too, and you'll find the job easier if you'll let us help. For example, the motor drive shown below is right "on target". By incorporating a motor, an electric brake, a mechanical variable speed unit, and a gear reduction . . . all designed and built into one compact integral power unit . . . it provides variable speed at exactly the right range and in addition can be quickly and accurately stopped at exactly the point desired. It mounts neatly on the machine, saves space, saves money and greatly improves the output, safety, appearance and convenience of the equipment.

Probably you will not need exactly the same combination of motor features illustrated below, but the Master line includes motors for every current specification, every type of enclosure, and every type of mounting arrangement . . . in fact, is the most flexible, the most versatile line of motor drives.

Investigate Master's unusual ability to serve you with motors that are right "on target".

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

BUY UNITED STATES WAR BONDS AND STAMPS

AN F.I.S.* STUDY WILL BRING TO LIGHT

The Right "Seeing" Conditions for All Critical Work-Areas in Your Plant

HOW SEEING NEEDS VARY IN PLANT OPERATIONS

20 Footcandles illumination needed

30-50 Footcandles illumination needed

50-100 Footcandles illumination needed

Over 100 Footcandles illumination needed

*FOSTORIA INDUSTRIAL SERVICE

Wide variations in worker seeing needs are common in every plant. As different jobs require different tools, so do different tasks require different light for efficient work performance—a fact of vital importance wherever critical work-areas exist.

A study of your plant lighting problems logically starts with the seeing need of individual tasks and carries on to the determination of proper equipment which will provide the right seeing condition for every workman in your plant.

Fostoria Industrial Service Centers, located in major industrial cities, specialize in this fundamental study of industrial lighting systems. Put your illumination problems in the hands of these qualified specialists. Their counsel is available to you without obligation.

FOSTORIA INDUSTRIAL SERVICE
Factory and General Offices FOSTORIA, Ohio

IN CANADA: Write Amalgamated Electric Corp., Toronto

FOSTORIA INDUSTRIAL SERVICE CENTERS

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1021 Chestnut St.
Phone 6-6194

CHICAGO
747 W. Jackson Blvd.
Haymarket 8150

CLEVELAND
4500 Euclid Ave.
Endicott 6622

DETROIT
12171 Grand River Ave.
Hogarth 1850

INDIANAPOLIS
548 Massachusetts Ave.
Riley 2934

LOS ANGELES
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Prospect 6011

MILWAUKEE
104 East Mason St.
Daly 2949

MINNEAPOLIS
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Atlantic 7363

NEW HAVEN
(Hamden, Conn.)
1240 Whitney Ave.
Phone 6-6194

NEW YORK
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Worth 2-3352

OMAHA
1107 Farnam St.
Atlantic 5540

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(Bala-Cynwyd, Pa.)
349 Montgomery Ave.
Greenwood 4477

PITTSBURGH
5339 Penn Ave.
Highland 9900

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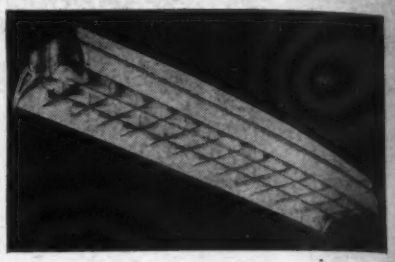
GENERALITES for Overall Lighting • LOCALITES for Light ON the Job

Trade Mark Reg. U. S. Pat. Off.

volt d.c., and consumes 4 amps. when operating at 110 volts. Charles Bruning Co., Inc., 4700 W. Montrose Ave., Chicago.

Fluorescent Fixture

The Futurliter fluorescent fixture is intended to complement previously announced Aristolite model for similar applications in offices and drafting rooms, where an open type luminaire that does not trap bugs and dirt behind the glass diffuser is preferred for lower maintenance costs. The Futurliter employs the egg-crate louvers for shielding lamps—a construction which makes it difficult for dust to settle on vertical surfaces, and thereby contributes to greater light utilization with a minimum servicing cost. Designed for close-ceiling or ceiling suspensions, the Futurliter can be mounted singly, or in continuous runs to obtain 50 to 75 foot-candle installations. Each 48-in. unit can be used with either two or three 40-watt lamps, and is available with conventional ballasts with starter switches, or with Quick-Liter ballast that requires no starter switch. The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3.



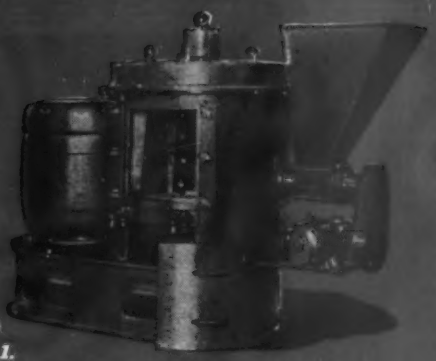
Portable Dust Collector

Portable, self-contained unit is designed for collecting dust from flexible shaft grinding, and lint and dirt from similar buffing and polishing operations. It consists of two separately functioning machines, (1) the Benchkop, a wooden bench with sheet-metal backstraps, to stop heavy particles, and (2) the Dustkop, which has its own motor, fan, cyclone separator and filter complete. The outlet of the Benchkop is connected to the intake of the Dustkop, or the latter unit can be used independently to handle the dust from a grinder operation. Rating of Model 1250 Dustkop is 1200 c.f.m. at velocities upwards of 4500 ft. per min., which is stated to be ample for handling the heavier types of abrasives. Recirculation of cleaned air throughout working space is featured as an advantageing heat saving. Aget Detroit Co., 602 First National Bldg., Ann Arbor, Mich.

Coolant Pump

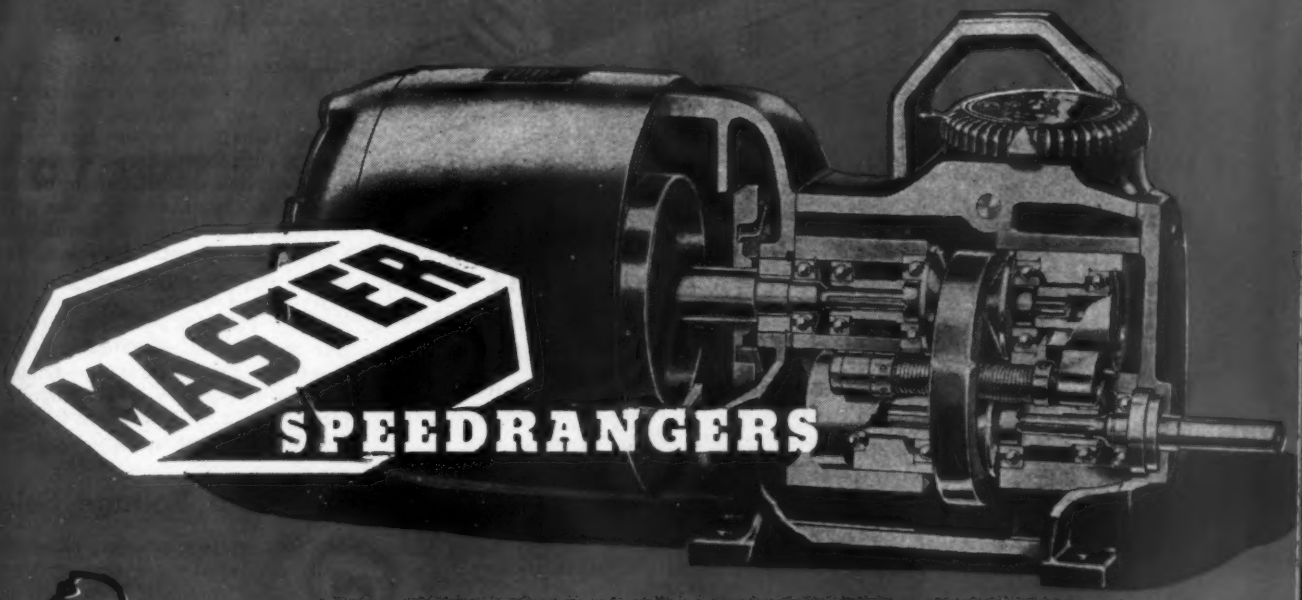
Model 1-P3 Gusher coolant pump is now offered for V-belt drive using a detached motor or drive shaft, with No. A belt. Pump operates in a vertical position, and employs a one-piece shaft, which revolves on two high-grade ball bearings mounted within the tubular section between the plate flange and the V-pulley. The pump stem, flange, and impeller housing are in-

BUY UNITED STATES WAR BONDS AND STAMPS



Available in sizes up to and including 3 horsepower in three different speed ranges—3 to 1, 6 to 1 and 9 to 1. Only with an all-metal drive can you secure the compactness, simplicity, flexibility and economy that are so advantageous today.

Infinitely variable speed may be secured to any R.P.M. within the range of the unit. The output speed is increased or decreased by variation of the position of the ring on the two driving and two driven cones.



MASTER SPEEDRANGERS

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

Available in the vast number of types that make up the Master line including the flanged type as shown, also gearhead, unibrake, fan-cooled, explosion-proof, splash-proof, multi-speed, etc.

Save material and save space with the simple compact, integrally built Master Speedranger. The all-metal construction insures greatest possible durability and freedom from service interruptions.

WHEN THERE'S WORK TO BE DONE . . .

United States Electrical Tools Do It

"Give us the tools," industry shouted, "and we'll produce the ammunition, the planes, the ships, the guns. But do it on the double-quick."

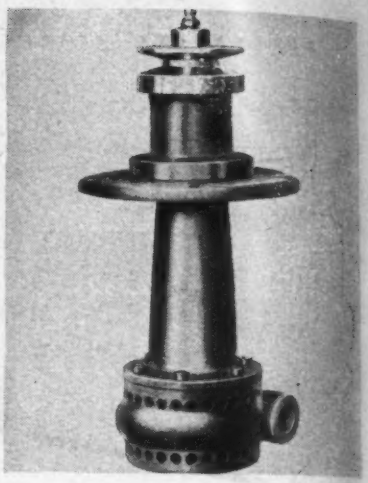
Our response was a thunderous, "You bet! We'll give you better electrical tools than ever and more of 'em. You'll get them in a hurry. They'll save you time; do the million-and-one jobs efficiently; save man power; step up production to unexpected heights; bring Victory closer."

And today THE UNITED STATES ELECTRICAL TOOL COMPANY is still doing its share . . . a big share . . . in helping you, the men who are pouring forth an endless stream of things the war effort demands relentlessly.

FLEXIBLE SHAFT MACHINES

For overhead or floor mounting. The power transmitted by a flexible shaft is governed by the diameter of the bore and the speed at which it is operated. Motors are ball bearing, 40-degree ratings and will stand a momentary overload of over 100%.

The **UNITED STATES ELECTRICAL TOOL** *Co.*
CINCINNATI, OHIO



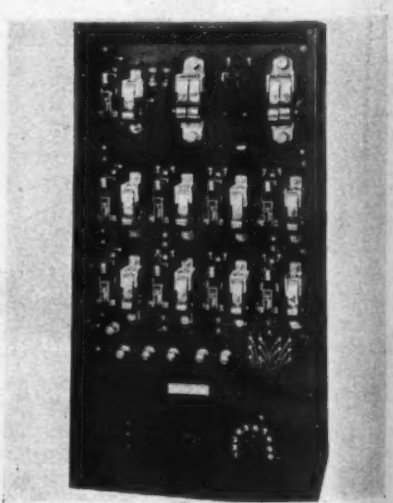
terchangeable with similar parts in direct motor-driven model already marketed. The Ruthman Machinery Co., 1818 Reading Rd., Cincinnati 2.

Fuse Clamps

Manufacturer of Wadsworth Type A and Type C switches announces that these switches are now being equipped with "Fuze Talons," a pressure-type fuse clamp that is designed to improve operation of both fuses and switch. One of the features is the grip clamp, which is screwed down to hold either blade- or ferrule-type fuse tight against fuse seat. Fuse seats are press-formed of pure copper, and grip clamps of heavy-gage plated steel. Advantage claimed for Fuze Talons is a positive electrical contact between fuse and fuse seats, thereby lowering the operating temperature. Product is listed by Underwriters Laboratories, Inc. The Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Magnetic Voltage Selector

Magnetic voltage selector, although especially developed for a new electro-plating process for anodizing aluminum on a.c., has many other uses where like applications of current are required. It is designed for "transferring" in steps from 2 to 40 volts. The arrangement is such that, when transferring, the main contact opens before the secondary contact opens, and closes after



BACK OF EVERY ATTACK—

Preformed wire rope

A tiny torpedo boat races toward the enemy to deliver the kiss of death. A young skipper mans the wheel—and Preformed wire rope helps steer the craft over sub-infested waters.

The PT lets go its torpedoes. Then twists and dodges to keep out of enemy fire. And Preformed wire rope helps it get away.

Where lives are at stake, Preformed has proved its superiority. That's why on PTs—it's Preformed.

Wherever the Allies attack, Preformed is on the job, proving its flexibility, its longer life—and its ability to save precious time.

That's why back of every attack—there's Preformed wire rope.

Ask your own wire rope manufacturer or supplier for Preformed wire rope

The label worth looking for

... *in waterproof work clothing*

Backed by over 60 years of experience, Rainfair Vulcanized is your guarantee of top-most quality in waterproof and acid-resisting clothing for all occupational needs. The complete line includes . . .

★ *RAINCOATS* ★ *HATS* ★ *APRONS* ★ *SUITS*
★ *LEGGINGS* ★ *INDUSTRIAL SPECIALTIES*

While military needs are our major responsibility today, we are able to furnish Vulcanized Work-Wear in limited amounts for essential civilian use. Write for condensed catalog of products and name of nearest Rainfair Distributor.

LOOK FOR *RAINFAIR* QUALITY FEATURES

Gum strapping vulcanized on shoulder seams and arm holes for water-tightness, strength.
Rainfair Vulcanizing assures 100% Waterproofness, unusual strength at seams, stubborn resistance to wear and deterioration.
Ample room throughout for freedom of action.
Reinforcing stays under fasteners give greater endurance.
Seams cemented, hand-rolled to make them 100% water-tight.
Rivets at points of strain provide extra strength for strenuous service.

RAINFAIR* INC.

*Reg. U. S. Pat. Off.

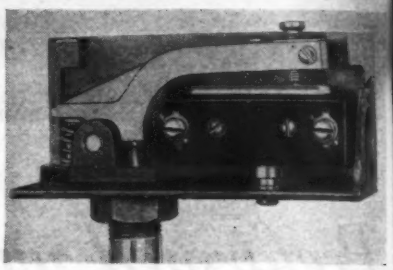
FORMERLY CHICAGO RUBBER CLOTHING CO., DEPT. 24-B, RACINE, WISCONSIN

Also Manufacturers of Rainfair Storm Coats and Coated Fabrics for Industry

the secondary contact in closed. Arcing is thus said to be effectually eliminated. Unit embodies automatic main magnetic contacts, and automatic main switch contacts for nine positions at 2½-volt intervals, from 2 to 40 volts. It is paneled for ready accessibility, and compactly cased. Zenith Electric Co., 152 W. Walton St., Chicago 10.

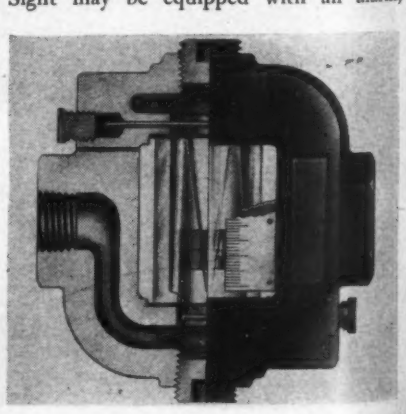
Temperature Control Switch

Model H temperature limit switch is available in several types to fit the application (1) with switch normally closed, for cutting off heat, stopping fan, or closing valve, (2) with switch normally open, for lighting lamp or ringing bell, (3) with single-pole, double-throw switch, for breaking heating circuit while closing alarm circuit. A sturdy, foolproof reset button is operated from outside the case. Other features of this switch include a corrosion- and heat-resisting tube, a dial pointer for easy setting, and a locking screw to lock temperature setting. Terminal plate has large screw terminals, and snap-action microswitch is said to eliminate contact troubles. Switch dimensions are 5½x1¾x3 inches. Switch is available in ranges up to 1400 deg. F., with adjustable range of 200 to 300 deg. F. Burling Instrument Co., 253 Springfield Ave., Newark, N. J.



Sight Flow Indicator

Rota-Sight is intended for flow indication in any application where an approximation of the amount of flow rate is an operating aid and necessity, such as flow of cooling water, lubricating oil, air agitation, filter feed, and gas leakage. Indicating float, which moves up and down in a pyrex tube in direct proportion to the amount of flow, gives instantaneous response to flow change. For visible or audible protection against dangerously low or high flows, Rota-Sight may be equipped with an alarm,



BUY MORE WAR BONDS

How to use an RCA Electron Tube for a Stop Watch

SUPPOSE your job depended on the accuracy with which you could—by watching a clock—time an operation that must not vary one half-second either way. How do you think your clock-watching eyes would feel, and what would your fatigue curve show, as the day wore on?

If electronic timers—and the electron tubes that make them work—did no more than free human beings from such nerve strain, they would rank high on the industrial front. But they do far more than that. For instance—

Here at RCA, we must carefully clean the many small parts that go into every tube we build. Otherwise the tube's performance may be faulty at final test and the tube must therefore be rejected, resulting in a loss of valuable time, materials, and facilities. One of the cleaning operations involves heating the parts by radio frequency currents which must be very closely time-controlled. It used to require a trained girl, timing herself by a clock, to operate the controls by hand. Now, two electronic timing circuits do the "dirty work" instead. Result: the automatic timing control is far more accurate and uniform than was possible by manual methods; production is faster and of better quality, so that fewer tube rejects occur; and the trained girl who used to operate the controls can now be used elsewhere to contribute to increased production.

The electronic timers for this operation were built by us for our use. While they are not currently available for sale, RCA engineers will gladly recommend electron tubes around which *your* engineers can build electronic timers that may greatly improve the accuracy and efficiency of your critical timing operations.

The magic brain of all electronic devices is a tube . . . and the fountainhead of modern tube development is RCA.

For a fascinating free booklet, *Electrons in Action at RCA*, write Room 470, RCA Victor Division, RADIO CORPORATION OF AMERICA, Camden, N. J.

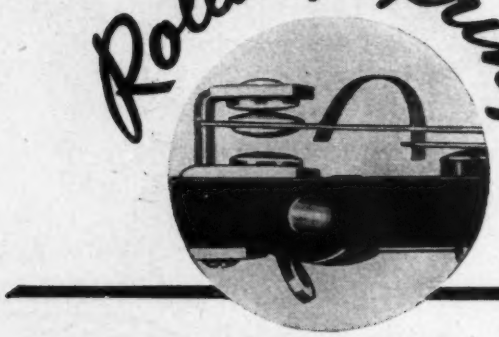
The RCA vacuum firing control uses two circuits to time the "on" and "off" periods. Each period can be controlled in 10 steps by separate dials over a range of ½ to 20 seconds. Duration of "off" and "on" periods is easily changed in processing parts of different sizes. Electronic timing controls can benefit many industries in replacing manual control of cyclic operations.

ASK ABOUT... RCA INDUSTRIAL MUSIC SERVICE

RADIO CORPORATION OF AMERICA

LOOK

to the Rolling Spring



Engineered for FASTER CONTACT BREAK

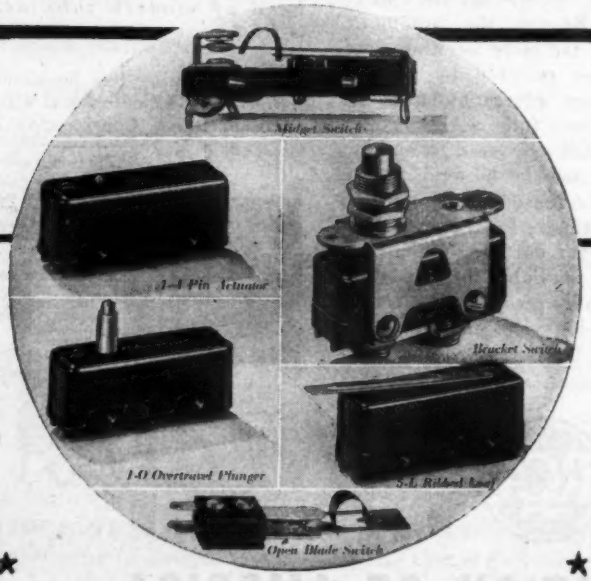
You can now design your product for better Snap Action Switches.

1. **Better contact pressure is maintained until the snap-action is actually begun.**
2. **The contacts break with maximum accelerating force.**

Those two facts account for the rapidly rising preference for ACRO-SNAP Switches. The spring forces involved are engineered to compel one spring to "trigger" the other. So regardless of how slowly the actuating member is operated, the contacts break with optimum acceleration. Careful analysis also shows that good contact pressure is maintained until the snap-action suddenly takes place. These facts are borne out by laboratory tests in industry and by record breaking performance in all branches of the Armed Forces. In writing, kindly explain details of applications you contemplate.

ACRO ELECTRIC COMPANY

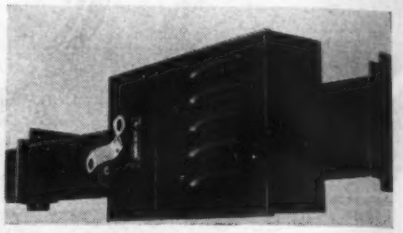
1309 Superior Avenue, Cleveland 14, Ohio



which is adjustable over the entire flow range of the instrument. Indicator is made in cast iron, bronze, and steel as standard materials, and can be also obtained in any corrosion-resistant metal that may be cast. Choice of horizontal or vertical inlets and outlets allows universal connections. Fischer & Porter Co., 9131 County Line Rd., Hatboro, Pa.

Capacitor Plugs

Capacitor plugs are designed to improve or relieve overload power distribution lines carried in "Bus Duct" run, and are said frequently to make possible the addition of new load without adding to bus bar sizes



already in use. They can be inserted into any convenient plug-in opening at the centers of greatest load areas, and can be readily moved about as the load areas change. Capacitor plugs are integral units, consisting of 60-amp., 3-pole fusible switches, or 15- to 50-amp. circuit breakers, connected ahead of 3-pole, single-unit capacitors having discharge resistors. They are made for 230- or 460-volt, 60-cycle service in capacitor ratings of 1 to 15 kva. Capacitor units have louvered screw-on covers. Special mechanism on hinged cover over protective devices permits pull-chain operation from the floor. BullDog Electric Products Co., 7610 Jos. Campau Ave., Detroit.

Metal Marking Ink

Brit-Mark-Ink has been developed for stenciling on metal parts or containers, and is said to meet U. S. government requirements for endurance. It is intended for use equally well in fountain brushes, fountain pencils, or with brush and pot. Maker states it is non-settling and non-clogging, also light-fast, waterproof, and oilproof. Available in black, white, yellow, orange, red, blue, and green; other colors can be made to order. Diagraph-Bradley Stencil Machine Corp., 3745 Forest Park Blvd., St. Louis 8.

Fluorescent Fixture

Commercial fluorescent unit, designated as Spero URC-448, is made for four 40-watt lamps, with translucent diffusing glass panels at side and bottom to shield the light source. The specially developed glass panels are said to eliminate all objectionable glare and shadows, at the same time to provide a high degree of light intensity, showing 16 foot-candles per watt per square foot under tests. Unit is offered in three types of mountings—flush-to-ceiling, pendent, or continuous row, which are stated to lend themselves to quick and simple installation. The glass panels are

Not a Lemon in a Blue Moon

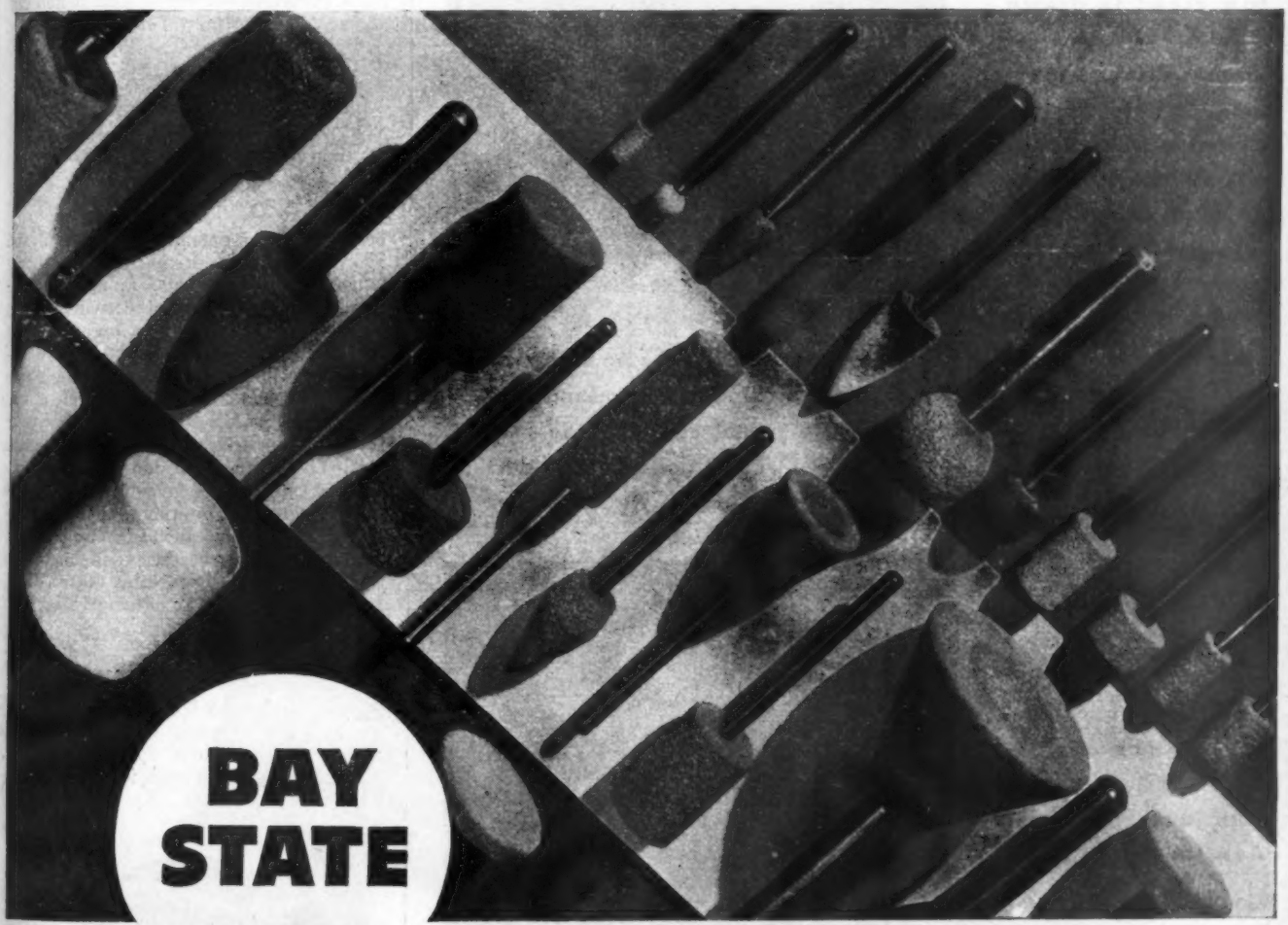
A very good reason exists why you'll have a hard time finding a mounted point or wheel with hard and soft spots among those bearing the Bay State *blue flash* trademark.

Bay State manufactures mounted points and wheels in *blank* form then shapes, trues and sizes them after mounting on the mandrel, in contrast to other makers' method of *pressing* into shape. The finished product is sharp, smooth-running the instant you touch it to the work — no wasteful "breaking-in" period required.

In a broad range of abrasive products, Bay State offers extra advantages... the finest honing and superfinishing stones ever manufactured... portable snagging wheels with extra safety features... precision grinding wheels in fractional grades...etc. Plus engineering assistance to help you get the most from grinding.

Do you have the handy, pocket-sized catalog of Bay State Mounted Wheels and Points? If not, send right away, for Catalog D.

BAY STATE ABRASIVE PRODUCTS CO.
WESTBORO, MASS.



BLUE FLASH GRINDING WHEELS *FAST and COOL*

HONING AND SUPERFINISHING STONES · CUT-OFF WHEELS · INSERTED-NUT DISCS AND CYLINDERS
PORTABLE SNAGGING WHEELS · MOUNTED WHEELS AND POINTS · GRINDING WHEELS

SLY DUST COLLECTOR TAKES PHARMACEUTICALS, TOO

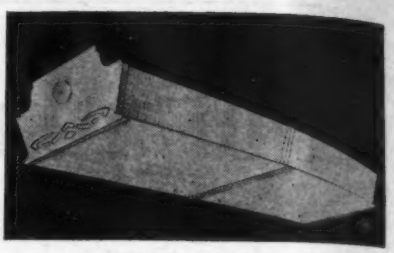
Dust created by grinders (at extreme left of top view) is drawn through the smaller upright ducts into the main air ducts and then to the filter (shown below) in this plant of a large pharmaceutical company.

KEEPS AIR CLEAN

Here the dust is thoroughly filtered from the air, keeping the plant spick and span, saving materials, and providing good working conditions. Installation was made over two years ago, and the user states that the Sly equipment has done an almost perfect job of dust collecting with a minimum of maintenance, adding, "We have been highly pleased with all phases of this installation." This is but one of over 5000 installations in operation today. Sly Dust Filters are collecting 111 kinds of dust in 57 industries. What is your dust problem? Ask for Bulletin 98.

SLY
INDUSTRIAL DUST CONTROL

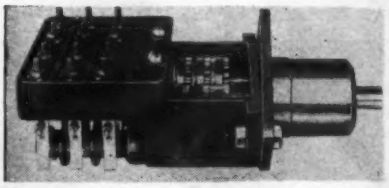
THE W. W. SLY MFG. CO. • Since 1874 • 4755 Train Avenue • Cleveland 2, Ohio



readily removed for cleaning and servicing lamps, and wiring is accessible from below. Unit is available with conventional type ballast and starters, or with "Insta-Lite," which combines functions of ballast and starter, providing instantaneous lighting. The Spero Electric Corp., 18222 Lanken Ave., Cleveland.

Geared Limit Switch

Two individual adjustable trains of intermittent gears are incorporated in limit switch, with each train operating one contact drum having three double-break contacts. Two of these contacts may be normally closed, or *vice versa*. The switch can



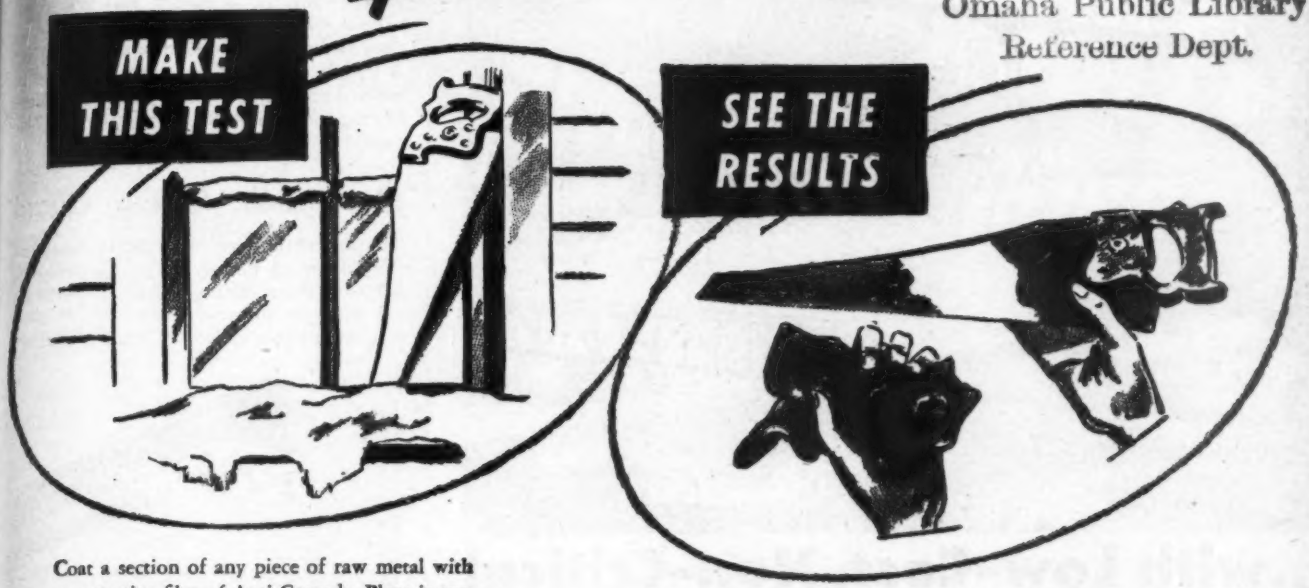
be adjusted for operation between 2 and 3333 turns of the driving shaft at speeds ranging from 10 to 500 r.p.m. The all-molded construction of the switch makes terminals easily accessible. Contacts, which are of silver, are double-break, and are self-cleaning. The contacts are rated for voltage up to 550-volts a.c. or d.c. Switch is said to be particularly suited for the control or the position indication of hoist or crane mechanism, automatic doors, valves, dampers, or any other mechanism where precision control or position indicated is required. Mounting can be in any position, and water-tight, weatherproof enclosures can be supplied. Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia 34.

Blower

All-purpose No. 6S Utility blower is available in eight different mounting arrangements, which include (1) blower only, (2) with stand, (3) with inlet flange, (4) with discharge flange, (5) with inlet and

How to *prevent* Corrosion

Omaha Public Library
Reference Dept.



Coat a section of any piece of raw metal with a protective film of Anti-Corrode. Place it out-of-doors, and leave exposed to the elements.

Rain, snow, changing temperature, dust and grime have eaten into and oxidized the unprotected metal. But note surface under Anti-Corrode film—bright and unharmed, in its original state.

CITIES SERVICE ANTI-CORRODE is a safe rust and corrosion preventive that brings amazing results. It is a reliable safeguard against corrosion of metals in any form or state of finish—whether in storage or in transit. Anti-Corrode forms a tenacious, durable film that is impervious to moisture and the more common gases prevalent in the atmosphere. And, since it contains lubricating material, it need not be removed in drawing operations. Anti-Corrode is made in several grades to meet specific requirements and severest tests. It is economical, easy to apply and can be removed with kerosene or any petroleum solvent.

This TEAM Will Save You Money and Materials

Recently, we announced the development of Cities Service Rust Remover, and responses to the demonstration offer far exceeded our expectations. Rust Remover, of course, *removes* rust. Anti-Corrode is designed to *prevent* rust and corrosion. Together, they will safeguard your equipment and war production—for the duration!

Take advantage of this FREE ANTI-CORRODE demonstration offer
Mail this coupon today!

(Available only in Cities Service marketing territory EAST of the Rockies.)

CITIES SERVICE OIL COMPANY
NEW YORK · CHICAGO
ARKANSAS FUEL OIL COMPANY
SHREVEPORT, LA.

CITIES SERVICE OIL COMPANY
Room 127, Sixty Wall Tower, New York 5, New York

Gentlemen: I would like to test Anti-Corrode on my own equipment FREE OF CHARGE. Please send me the details.

Name_____

Company_____

Address_____

City_____ State_____

..with Low-Cost, Non-Critical

Careyclad BLACK COATING

FOR METAL SURFACES AND BUILT-UP ROOFS

CAREYCLAD protects metal against rust and weather—is extremely durable, abrasion resistant, and resistant to acid, alkaline and salt solution and to moist, atmospheric conditions. It is a practical, low-cost coating for metal buildings, iron sheets, structural steel, bridges, heavy machinery, and numerous sheet metal products.

Applied by spray painting or brushing, at everyday indoor or outdoor temperatures. Promptly available through CAREY Branches and Distributors. Write for details, address Dept. 31.

THE PHILIP CAREY MFG. COMPANY

DEPENDABLE PRODUCTS SINCE 1873

LOCKLAND, CINCINNATI, OHIO

IN CANADA: THE PHILIP CAREY CO., LTD.
OFFICE AND FACTORY: LENNOXVILLE, P. Q.

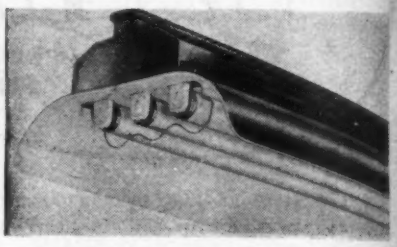
BUY EXTRA WAR BONDS.. NOW!

CAREYCLAD LASTS 100% LONGER THAN ORDINARY COATINGS

discharge flange, (6) with stand and inlet flange, (7) with stand and discharge flange, and (8) with stand, inlet, and discharge flange. Housing and stand are die-stamped steel. Zinc die-cast multi-blade wheel, which is said to be dynamically balanced, is direct-connected to motor, which is series-wound, 110-volt, single-phase, 60-cycle, sleeve-bearing type, operating at 3400 r.p.m. A length of cord is brought out of motor for making connections. Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago 41.

Fluorescent Safety Guard

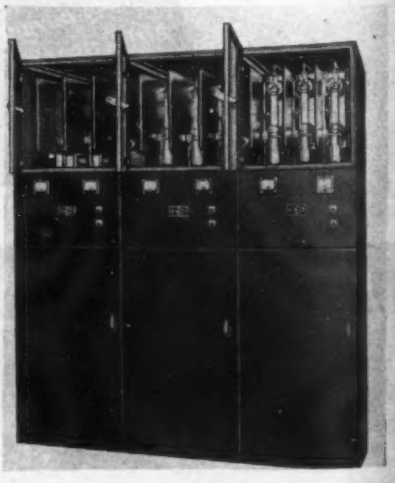
To protect workers and products against the danger of falling lamps, the Wheeler lamp retaining "safety guard" is offered for use with any make of 2-40, 3-40, or 2-100 watt fluorescent fixture. Guard is designed



to cradle and restrain any unlocked lamp so that it cannot shift downward enough to clear lampholders, making even axial movement impossible. Attachment of guard is said to be easy and quick, involving (1) removal of reflector from wiring channel, (2) insertion of clips through socket holes, and (3) anchoring of clip by sliding end over edge of reflector and pinching down if necessary. Safety Guard is easily compressed to obtain release of one side, thus allowing guard to swing free during relamping. Wheeler Reflector Co., 275 Congress St., Boston, Mass.

Motor Fuse Control

Designed for synchronous and induction motors, the E-M Hi-Fuse control is stated to combine dependable starting service with short-circuit protection through the use of split-cycle-operating, high-interrupting-capacity power fuses. Because of the split-cycle speed with which the fuses clear fault current, and the action of the fuse to



TODAY'S PROBLEM-
PLAN FOR TOMORROW
Today it's war and your only competition is Time. Tomorrow — Peace and with it keen competition in products, price and production in the wide open consumer market. **Economical production** will be tomorrow's vital factor in the manufacturing of any product and that is where Hansen PUSH-TITE air hose couplings come in.
They're easier and faster to operate, greater production with considerable savings in time and effort . . . Hansen couplings are leakproof which means not only trouble-free operation but a great savings in "air" alone, in many cases sufficient to more than pay for the actual cost of couplings.
If it's air, oil or grease lines it's Hansen PUSH-TITE Couplings because of their outstanding performance and definite savings.
Send for Free Catalog, covering the complete Hansen industrial line.
Hansen
AIR HOSE COUPLINGS
AIR HOSE COUPLINGS • HOSE CLAMP SOCKETS • HOSE CLAMPS
AIR BLOW GUNS • HOSE CLAMP PLUGS • ENGINE CLEANERS
SANDBLAST CLEANERS • AIR-LIQUID SPRAY GUNS
ANSEN MFG. CO
ANSEN MANUFACTURING COMPANY
1786 EAST 27th STREET • • • CLEVELAND, OHIO

A TORNADO IS A SPIRAL, TOO!

Standard the world over for more than half a century, "Yankee" Spiral Ratchet Screw Drivers are now helping to produce a tornado of ordnance to flatten the Axis. Simple, compact, strong, and ingenious, they and other "Yankee" Fine Mechanics' Tools are saving time, trouble, and money in the Battle of Production. At war's end, of course, they will again be available where and when you want to buy them . . . and they'll have new war-tested skill behind them. Meanwhile, treat them right. Tools are weapons of war.

Order from your supply house, or write North Bros. Mfg. Co., Dept. FMM-244, Phila., Pa. Furnish priority ratings whenever possible, and every effort will be made to fill your orders.

"YANKEE" SPIRAL SCREW DRIVER NO. 130A
A Size for Every Purpose

"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila. 33, U. S. A.
Established 1880

limit current, it is claimed that the motor switch, while amply strong to withstand the momentary fault current, does not have to be of the more costly high-interrupting-capacity type. The Hi-Fuse control is said to afford protection for the motor against abnormal operation in starting or running. For synchronous motors, the E-M polarized field control is featured, which is stated to be a simple, accurate, polarized relay that gives smoothness and maximum power in synchronizing the motor. Hi-Fuse controls can be furnished in live-front or dead-front, as well as the metal-enclosed type illustrated. Electric Machinery Mfg. Co., Minneapolis 13.

Continuous Fluorescent Units

Basic sections of Smithcraft fluorescent units in 8-ft. 6-in. lengths are designed for continuous run where illumination levels

of 50 or more foot-candles are desired. When used in conjunction with 4-ft. 3-in. lengths as fill-in sections, maker claims installation labor costs are cut. A. L. Smith Iron Co., Chelsea 50, Mass.

Sheave

Magic-Corp sheave is designed for quick and easy mounting and dismounting. When mounting, it is slid on shaft to exact position desired, and as three capscrews are tightened, its tapered split bushing is drawn into the sheave, locking sheave to

shaft. For dismounting, the three capscrews are first removed, then two of them are inserted in tapped holes in bushing collar to separate bushing from sheave, and entire assembly can be slid off. Design permits sheave to be mounted close to motor. Sheave is available in all standard diameters and groove numbers. Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1.

Rotary Limit Switch

Twelve-circuit, direct-connected, rotary-type limit switch is announced. It has twelve individual contact drums, each of which is separately adjustable by small in-

PHYSICAL AND CHEMICAL PROPERTIES OF "dag" COLLOIDAL GRAPHITE

1 Slippery—a Good Lubricant. Softer than talc

2 Conducts Electricity

3 Withstands Temperature Extremes

4 Absorbs, Radiates and Conducts Heat

5 Maximum Purity

6 Low Coefficient of Expansion

7 Particles Bear Like Electric Charges

8 Insoluble in Acids and Alkalies

9 Black and Opaque

10 Gas Adsorbent

11 Little Photoelectric Effect

12 Miscible with Most Fluids

13 Films Adhere Tenaciously and Dry [illegible]

14 Microscopically Fine Particles.

15 An Excellent Suspension

Available as a smooth, black, liquid concentrate, Dag colloidal graphite puts a versatile company of physical and chemical properties at your service. Fifteen of the more important of these properties are listed here with a different color given to each for easy reference.

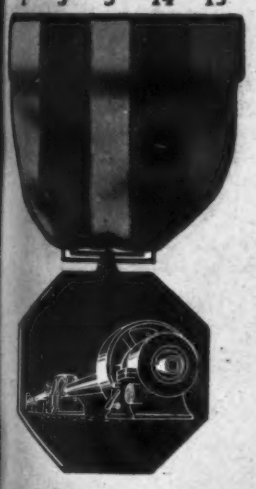
Match these properties by color with the colors on the medals below. Each medal represents a typical performance "citation" to Dag colloidal graphite. Dozens more could be shown, if space permitted, because this product is a dry film, a fluid film, a surface coating, an impregnation—and a few other things besides.

"Mr. Dag"

2 14 13 15

2, 14, 13, 15 CITATION: "Drive belts and other nonconductors traveling at high speed accumulate static charges which under certain conditions may constitute a hazard. This static electricity is controlled and bled-off harmlessly by a Dag colloidal graphite conductive film."

1 3 5 14 15



1, 3, 5, 14, 15 CITATION: "When the work rotating chuck of this large honing machine was assembled and run-in using Dag colloidal graphite, running-in time was reduced approximately 35%, operating temperature dropped considerably, and the danger of bearing damage due to temporary oil film failure was eliminated."

9 13 6 14 15

9, 13, 6, 14, 15 CITATION: "Dag colloidal graphite is used to retouch photograph negatives because of its complete opacity, because a film of minimum thickness is required and because it dries with a sharp edge."

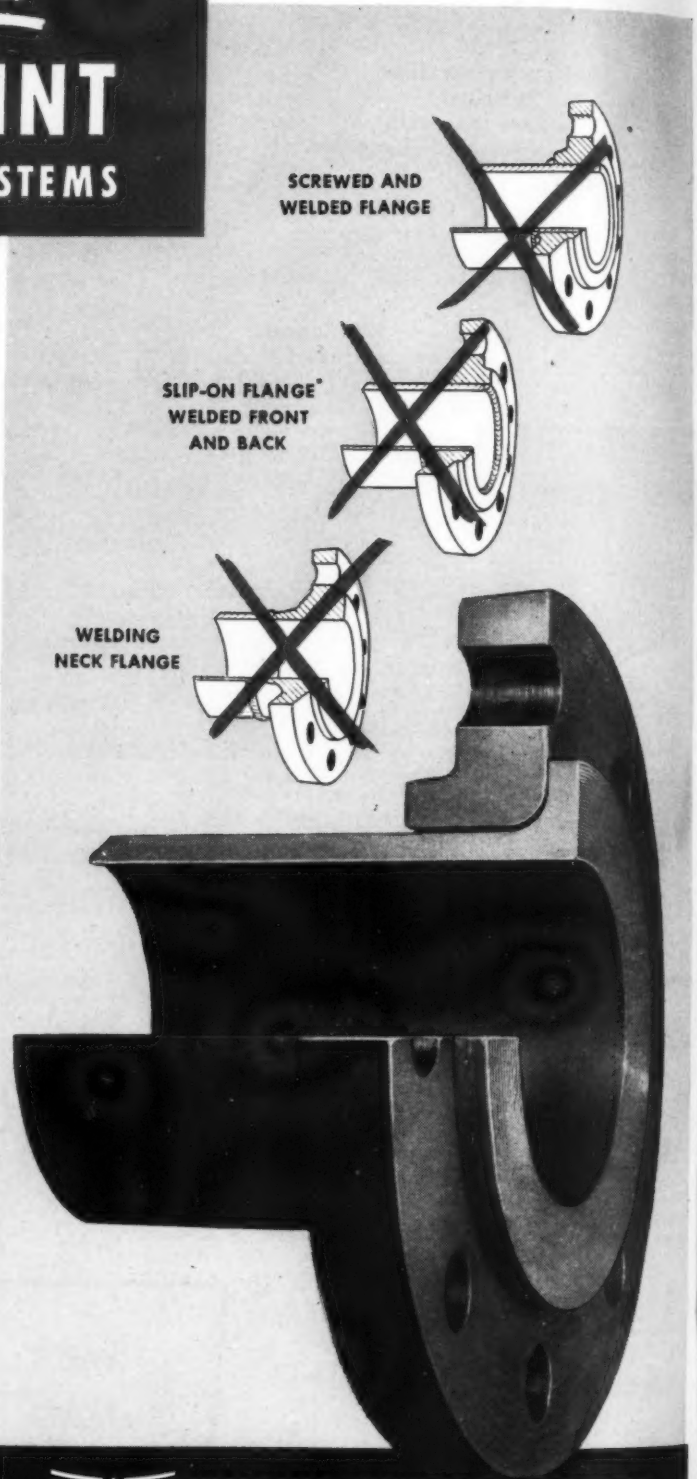
CHECK THE LIST and pick out those properties which you can use. Then state your problem to us and let our engineers give you the benefit of their experience. It is quite possible that they have already studied a parallel application. You'll pin a medal on yourself for calling in Mr. Dag.

Dag, Oildag, Aquadag, Castordag, Glydag and Prodag are registered trade marks of Acheson Colloids Corporation. Copr. 1944 by Acheson Colloids Corp.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

THE *Preferred* FLANGED JOINT
FOR WELDED PIPING SYSTEMS



MIDWEST

LAP-JOINT STUB ENDS

For making connections to boilers, pumps, valves and other flanged outlets (and where piping must be frequently cleaned or inspected for corrosion), Midwest Lap-Joint Stub Ends have a tremendous advantage over flanges that are welded to the pipe (see drawings at right above). The swivel flange on the Stub End makes it unnecessary to accurately line up the bolt holes before welding; "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding.

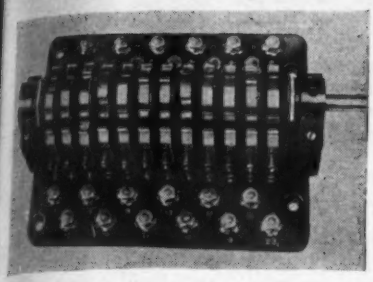
Another important economy is in erection. Field organizations report a saving of 25% in erection time for making up a joint using Midwest Lap-Joint Stub Ends in comparison with flanges rigidly fixed to the pipe; this saving is even greater when the flanges are on bends.

See Bulletin WF-41 for complete data regarding Midwest Lap-Joint Stub Ends . . . and the many other Midwest Welding Fittings that simplify and save on welded piping.

MIDWEST PIPING & SUPPLY CO., Inc.
Main Office: 1450 South Second St., St. Louis 4, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • Tulsa—533 Mayo Building.

MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS



crements. It can be used either as a continuously rotating or a reversing switch and is suitable for operation in any position. The all-molded construction provides easily accessible terminals. Switch features—silver to silver wiping and self-cleaning double-break contacts, and needle-bearing shaft suspension. Contacts are rated for 125-volt a.c. applications. Switch is said to be suited for service requiring a multi-contact limit switch having flexibility and ease of adjustment. Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia 34.

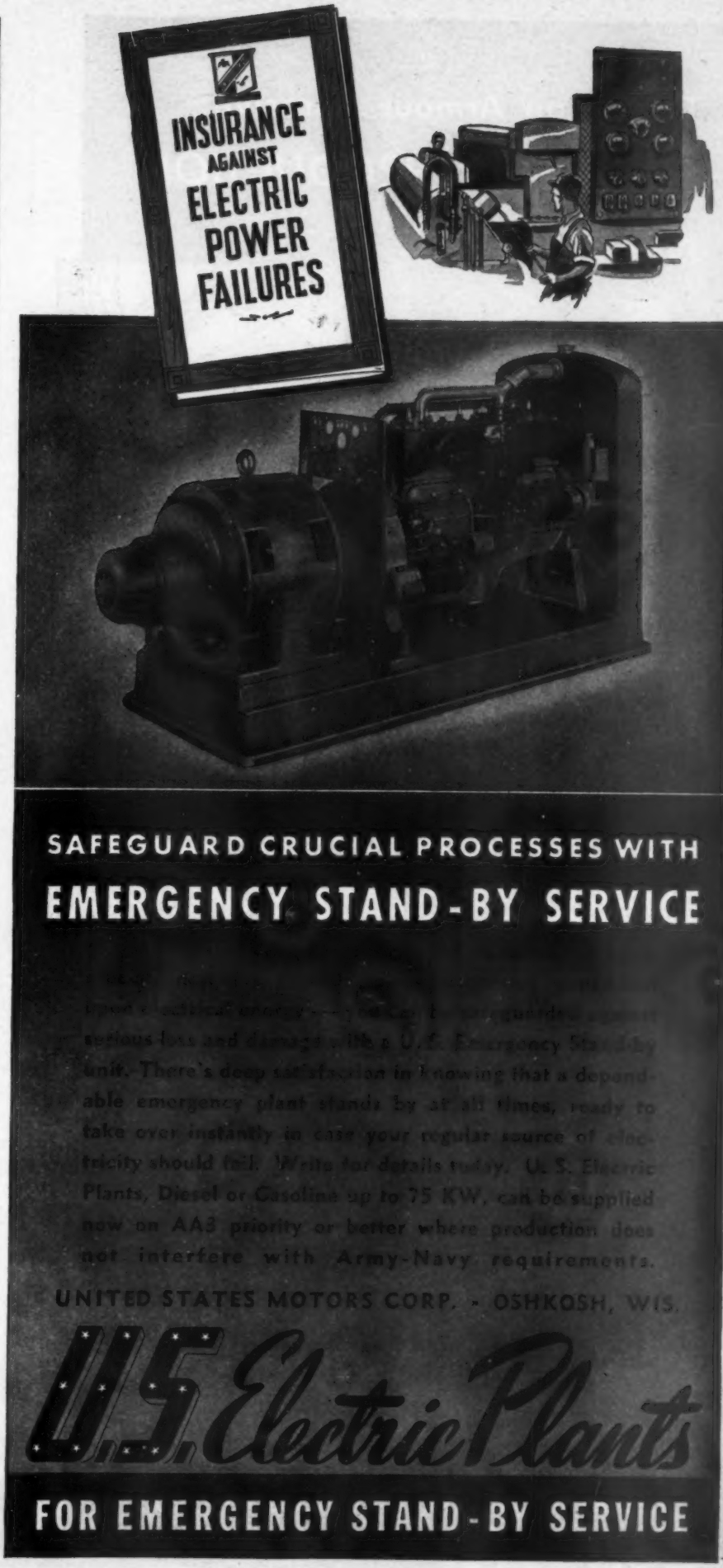
Infra-Red Lamp

"Superlock" construction for use in Birdseye infra-red lamps is claimed to withstand the terriffic temperatures of infra-red tunnel use. The design includes a base lining made with special protrusions fitting tightly into indentations in the neck of the bulb

and locked in position by special crimping of the metal base. This is said to give a permanently sealed, locked base that is impervious to heat. A ceramic heat reflector disk replaces the mica disk formerly used. Wabash Appliance Corp., 335 Carroll St., Brooklyn, N. Y.

Alkali Steel Cleaner

Development of an alkali material for cleaning steel, called Cleaner 100, is announced. This product is used in a concentration from 4 to 8 ounces per gallon in the temperature range from 180-212 deg. F. It is stated to have high detergency, and is best used anodically, but it is also claimed to be an effective immersion cleaner. Advantages claimed for the product include excellent rinsability and long life due to "buffering" and to selection of surface active materials. Cleaner 100 is said not to contain soap such as rosin soap, but to contain complex phosphates to solubilize any fatty acid soap that may



There's an Armour Abrasive
FOR EVERY PRODUCTION NEED . . .

Armour's Electrocoated Alundum Cloth
Supplied in 50 yd. economy rolls. Used in many finishing operations, on steel, bronze, aluminum, etc.

Armour's Fibre Combination Sanding Discs
Available in a range of grits and sizes, used in cutting welds, removing burrs and leveling metal surfaces.

Armour's Electrocoated Alundum Cloth Sheets
find many applications in the precise hand finishing of metal surfaces.

Armour's Alundum Cloth Spiral Wound Bands
Available in several sizes and grits—for cutting and polishing inside walls or hard-to-get-at places on cast machine parts.

Whether you work in aluminum, brass or steel...Whether you finish propeller blades, cylinder heads or tank turrets...There's an Armour Abrasive engineered to your requirements.

We take particular pains to build long life, and clean, even performance into Armour Abrasives. They are proving their dependability in the stepped-up pace of American war production today. We believe that at least one of the Armour abrasives described here fits into your production picture...and we would welcome the opportunity to discuss your abrasive needs with you in detail...at your plant, on the job. No obligation, of course—write or call Armour Sandpaper Works.

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ARMOUR SANDPAPER WORKS
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form from greases and oils being removed. The cleaner is claimed to be effective in soft and hard water and to form no insoluble residues due to reaction with acids. The Enthone Co., 442 Elm St., New Haven, Conn.

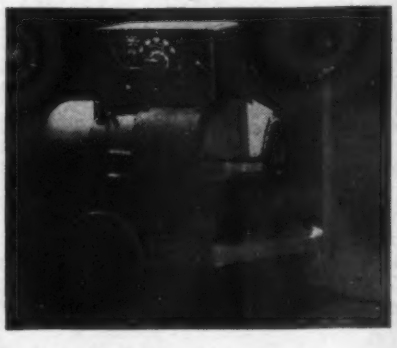
Fluorescent Fixture

Model HF-235R industrial fluorescent unit is announced as the third in a series designed for areas where high levels of illumination are required, or where high-bay mounting is necessary. Unit uses two 100-watt lamps and is streamlined. It can be

mounted individually or in a continuous row, and suspension may be obtained by direct chain, conduit, messenger cable, or surface mounting. Complete hanging flexibility is said to be assured through one-half inch knockouts located on 24-, 30-, 36-, and 47¾-in. centers. Starters are located between lamps for ease in maintenance, and reflector can be easily removed from the top housing by a quarter-turn of the "captive latches." Sylvania Electric Products Inc., Lighting Div., Salem, Mass.

Arc Welder

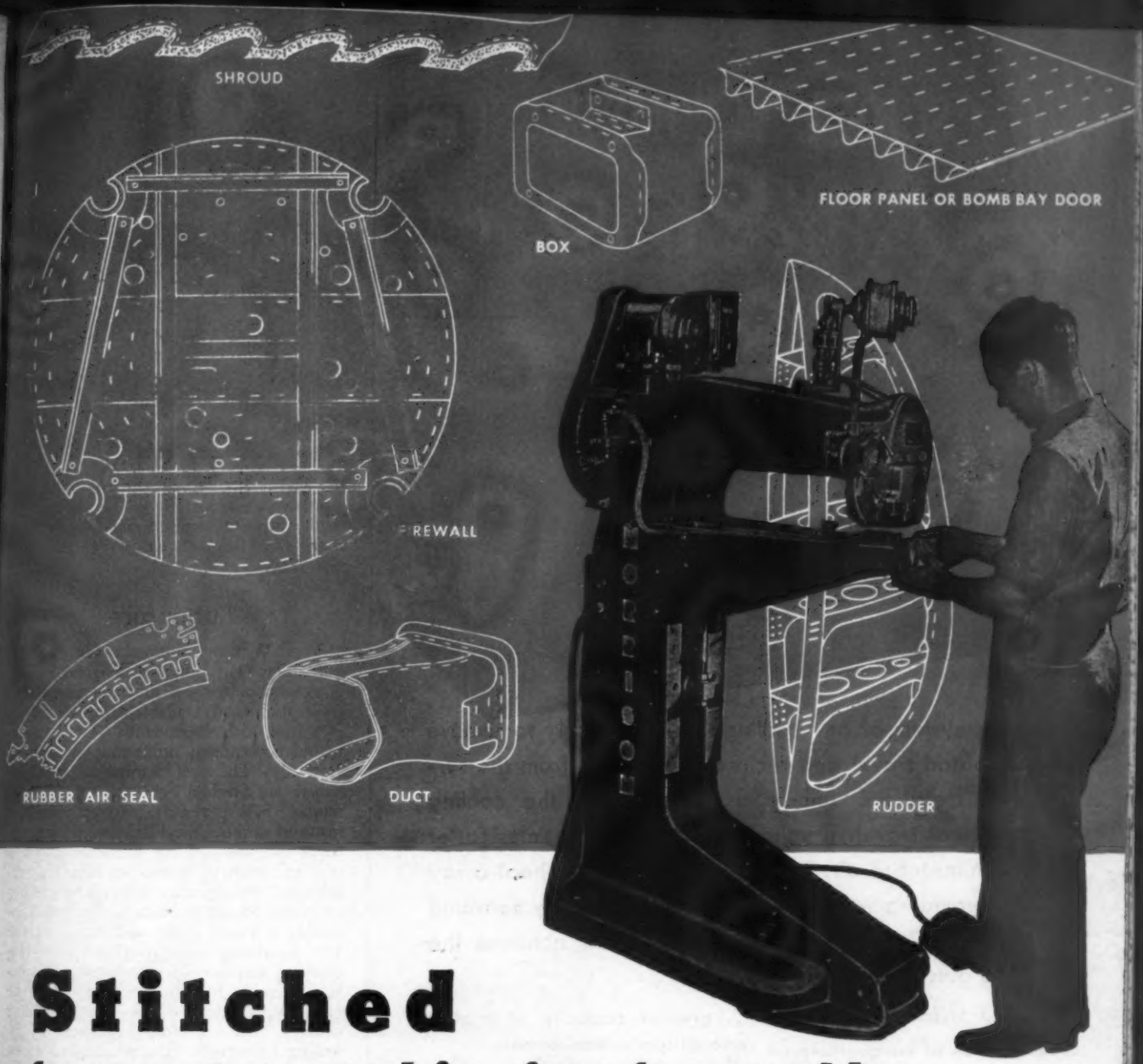
Type WD-30 series of d.c. single-operator arc welders has been improved by two new control dials and a redesigned driving motor. The control dials permit pre-setting of welding current without reference to a volt-ammeter. One dial, calibrated in terms



of electrode size, is set by operator to correspond to size of electrode being used, and the other dial, indicating range of welding current available for use under these conditions, is pre-set to whatever amperage is desired. The driving motor has heavier insulation and special weather-protective features. General Electric Co., Schenectady.

Badge Holder

Leather holder is designed to provide for combination employee identification, such as badge number and position; to eliminate inconvenience of handling each separately. The regular identification badge is fastened at the low end of leather strap, and above



Stitched

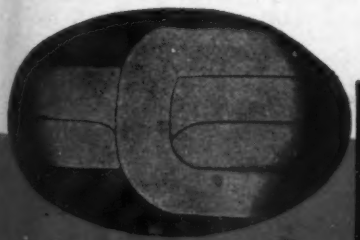
for greater speed in aircraft assembly

Above are shown some typical examples of aircraft stitching done on the MORRISON AIRCRAFT METAL STITCHER. More and more parts are being converted to stitching as manufacturers find the remarkable time-saving involved. *Man hours have been cut 86% in one plant alone.*

Morrison Stitchers form, clinch and drive stitches in a single operation . . . make clean exit holes with no tearing of metal . . . handle combinations of materials. They are simple to operate, only one operator is required and no special skill is demanded. Maintenance is reduced to a minimum . . . Morrison Stitchers are ruggedly built.

If you are riveting or spot welding Aluminum, Stainless Steel, Plastics, Cork, Rubber, Asbestos, Wood or Canvas, it will pay you to investigate Morrison Aircraft Metal Stitchers. Write today for Bulletin No. 10-F.

BUY WAR BONDS



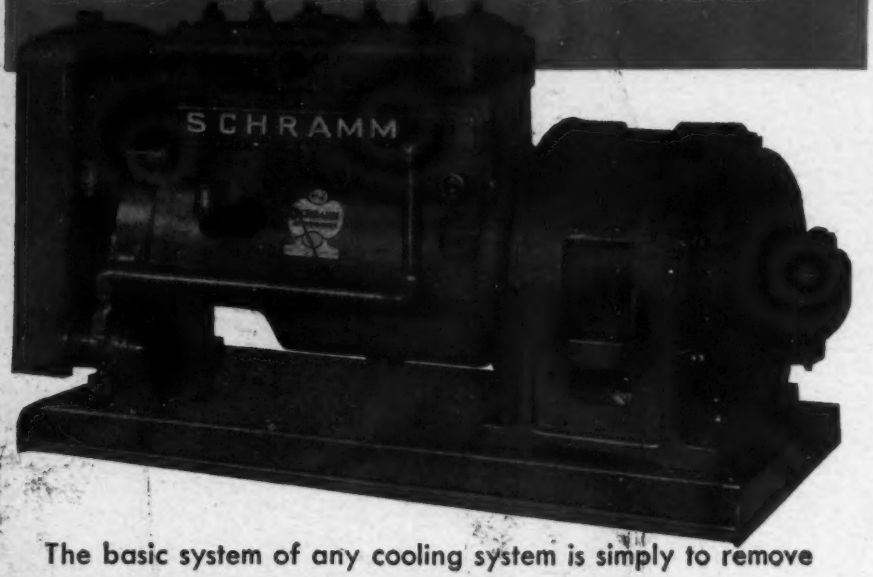
Actual photograph, magnified several times, of cross section of stitch driven through two sheets of 24ST .040 Aluminum.

MORRISON

PRODUCTS OF THE SEYBOLD DIVISION
HARRIS-SEYBOLD-POTTER COMPANY
DAYTON F7, OHIO

STITCHERS

Why SCHRAMM COMPRESSORS are Water Cooled!



The basic system of any cooling system is simply to remove heat of piston travel and reciprocating parts from the surrounding metal as quickly as possible by the cooling medium. Heat travels from metal to water 200 times faster than from metal to air. By using water to carry heat away and by providing water jackets which completely surround compressor cylinders and heads, SCHRAMM achieves the following outstanding advantages:

...assured uniformity in cooling.

...elimination of unequal expansion and contraction which might cause distortion.

...absolute control of operating temperatures to the desired degree.

...longer life to compressor parts.

...higher efficiency of compressive cycle.

...higher compressor capacity at lower power cost.

...greater capacity in smaller overall space requirements.

...ability to provide compressed air efficiently under any and all temperature conditions.

...ability to provide compressed "air where it's needed," regardless of the amount of water available for cooling. SCHRAMM compressors are built in types equipped for re-cooling water (as well as for running water).

Get all the facts... NOW!

Write at once for complete details. Send for Catalog No. 42-S.

SCHRAMM, INC., WEST CHESTER, PA.

THE COMPRESSOR PEOPLE

SCHRAMM Air Compressors

the badge is fastened the committee or position identification. The holder is fastened to clothing by a metal spring clasp at the top. Royal Incentives, 41 John St., New York 7.

Luminaire

The "Warrior" luminaire for four 40-watt fluorescent lamps, is designed for use in general offices and drafting rooms. Individual units are available either for ceiling mounting or as pendants. Unit comes within government limitations order L-78 (revised). The steel channel and pendant hanger are finished light gray. Louver assembly, ballast shields, and reflector are made of nonmetallic Fluratex and are finished with glossy white Fluracite, a baked synthetic material claimed to have high reflection. By releasing two spring catches on either side of the fixture, the louver assembly is swung down and hangs on the two remaining spring catches, permitting cleaning and lamp replacement. The entire assembly may be removed from the channel by releasing the two remaining catches. The reflector is removed by releasing 4 wingnuts. Starters are located on top of the fixture channel and may be reached without removing any other fixture parts. Curtis Lighting, Inc., 6135 West 65th Street, Chicago 38.

Combination Drum Truck and Drain Rack

Designed especially to handle oil drums, truck acts in dual capacity of drain rack as well. Manufacturer stresses easy, automatic loading feature, in which truck is tilted against drum, steel fingers are slid down to engage top rim of drum, and truck is rocked back into wheeling position. A further downward push on truck handles to horizontal position converts truck to drain

NO TRAINING REQUIRED

Any inexperienced man (or woman) can operate a Lo-Hed Hoist

How can industry speed up production with inexperienced operators? Here's one way: When it's materials to be moved, the answer is a speedy, convenient, Lo-Hed Electric Hoist. With a Lo-Hed back-breaking *hand*-handling is eliminated.

Inexperienced hands can dig right into faster productive work with a Lo-Hed. It's easy to operate. Absolutely no training time is required.

Lo-Hed Electric Hoists are designed for consistent year-in and year-out operation, built so that maintenance attention is held to a minimum. Get full information today.

LO-HED IS THE "BALANCED" HOIST FOR HEAVY DUTY SERVICE

The "balanced" arrangement of motor and drum in a Lo-Hed Hoist allows the hook to be pulled up until it almost touches the beam—a desirable plus feature for which you pay no premium. This same arrangement makes possible the use of an all spur gear drive from motor to drum.

Other important features of the Lo-Hed Hoist are the heavy duty hoist motor; strong, short shafts; high duty bearings; 100% positive automatic stop; and removable protective covers for all vital parts.

The Lo-Hed Hoist can be adapted for operation on any monorail system. There's a Balanced Lo-Hed Electric Hoist for Every Purpose.

See your classified Telephone Directory under
"A-E-CO LO-HED HOISTS"
for your nearest representative.

AE CO 75th ANNIVERSARY

Other A-E-CO Products:
TAYLOR STOKERS • HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

AMERICAN ENGINEERING COMPANY

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WARTIME APPLICATIONS

PLANES — removes chips and rivets, cleans before painting. Cleans hangars, equipment, hulls, wings and tanks.

INSTRUMENTS — bench work, assembly, inspection, vacuum for schools and testing.

CHEMICAL — cleans goods, prevents explosions in alcohol, paint, TNT, asbestos, and synthetic rubber plants. Reclaims lime, rubber, flux and valuable dusts.

METALS — reduces danger of explosions of magnesium dust, eliminates health hazard, removes chips, scale and abrasives. Collects ores, conveys slag, recovers metals.

SHIPS: Saves man-power, from bench work to final inspection. Removes sand blast and shot, cleans before painting.

Look what the War did to SPENCER VACUUM!

We show the pre-war applications for Spencer Vacuum above because we are not yet allowed to secure photographs of the many new and revolutionary applications listed at the left.

In all cases Spencer has speeded up operations with less man-power required for the job.

Some say that bench and assembly cleaning is the most valuable use of the Spencer. Others point to the reclamation of materials, reduction of fire and health hazards, or the fact that Spencer provides a new conception of streamlined production where cleaning between operations is necessary.

POST-WAR production will find these applications a necessity in order to compete with other plants that already have Spencers installed. Why not ask for the bulletins?

SPENCER HARTFORD VACUUM CLEANING

THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

rack. All-welded construction includes heavy angle-iron frame and tubular handles, with two 8-in. roller-bearing wheels. Palmer-Shile Co., 7110 W. Jefferson Ave., Detroit 17.

Remote-Control Circuit Breaker

Klixon remote-control circuit breakers are designed for operation and control of any remote electrical load in mobile applications. The actuating element is the snap-acting "Spencer Disk," which provides a positive make and break, and is unaffected by motion, vibration or shock encountered

in mobile equipment. The circuit breaker is calibrated to precision tolerances and will carry at least 115 percent of rated current continuously, and will ultimately trip at 125 percent of rated current in an ambient temperature of 77 deg. F. It is available either for "trip-free" operation, whereby the relay is free to open irrespective of the maintenance of remote-control handle in closed position, or for "non-trip-free" operation, whereby the operator can override the action of the circuit-breaker relay from the remote-control panel. Circuit breakers are available in three frame sizes, with current ratings from 35 to 200 amp. for circuits up to and including 30-volts d.c. or 220-volts a.c. Spencer Thermostat Co., 40 Forest St., Attleboro, Mass.

Unit Heater

Industrial electric unit heater, called Electromode, is designed for heating isolated buildings and spaces where intermittent and high heating efficiency is desired. It is available in either portable or suspension models from 1½-kw. to 4-kw. capacities, and in suspension models from 5-kw. to 60-kw. capacities. Portable models are equipped with carrying handles; suspension models are furnished with either eyebolts or straps. Manufacturer claims Electromode maintains an even temperature from floor to ceiling by constant air circulation that eliminates air stratification. Grids are said to attain full heat rapidly, and thermostatic control assures economic operation. Complete protection from excessive overheating from any cause is provided by thermal cut-

PLAN FOR TODAY AND TOMORROW WITH T-J FOR *Tough Jobs!*

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Whether it's a job for Rivitors... hydraulic cylinders ...air cylinders...cutters...Clinchors...or air controls... you can count on T-J for unbeatable efficiency, accuracy and dependable performance! All T-J products built to precise standards of manufacture...rigidly inspected... backed by practical-minded experienced engineering. In planning a better production set-up for better products...specify T-J Quality! Write for bulletins.

The Tomkins-Johnson Co., Jackson, Mich.

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FOR UNDERFLOOR ELECTRICAL DISTRIBUTION

General Electric offers two types of underfloor wiring. Both give almost unbelievable flexibility to shops, factories, offices, etc. Electrical outlets can be added later as they are needed.

Use G-E FIBERDUCT With Masonry and Wood Type Construction

G-E Fiberduct installation.

Use G-E Q-FLOOR WIRING With Robertson Q-Floors

G-E Q-Floor Wiring installation.

Send the coupon for catalogs giving further information on these flexible underfloor wiring systems.

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Appliance and Merchandise Department
Bridgeport, Conn.

Sirs: Please send me: ☐ The G-E Fiberduct Catalog
☐ The G-E Q-Floor Wiring Catalog

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Address .....

City ..... State .....

GENERAL ELECTRIC

outs. Electric Air Heater Co., Div. of American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.

Fluorescent Starter

Featuring a simple form of thermal switch in series with timing switch, starter is announced for use with 40- and 100-watt fluorescent lamps that is claimed to eliminate "blinking" and to save power by reducing current flow through lamp auxiliaries when lamp burns out. When the lamp is in good operating condition the starter functions normally in preheating the cathodes in usual manner. When the lamp fails, starter makes only a few attempts to start the lamp, because resultant heat causes thermal switch to open the lamp circuit permanently. When the burned-out lamp is replaced, starter automatically resets to its normal position and resumes its normal lamp-lighting function. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Portable Table

The Multiduty rolling table serves as a portable work bench, as a die set separator and lifting table for the storing, moving, and setting up of dies, or as a lifting table for supporting bars and sheets for milling and similar operations. Incorporating a small crank-operated overhead hoist, it is said to enable user to handle any piece quickly and smoothly without damaging

EVERYTHING FOR PIPING...

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Send for complete catalogs and remember Grinnell "whenever Piping is involved."

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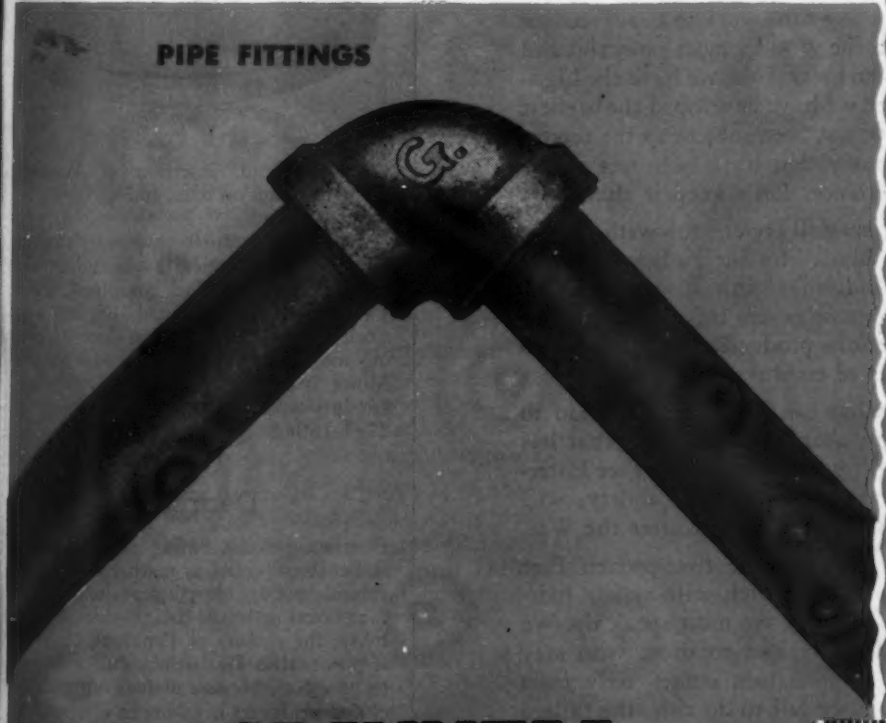

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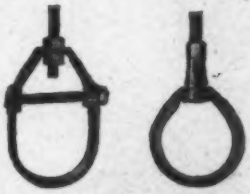

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Welding Fittings

Pre-Engineered Spring Hanger

Grinnell-Saunders Diaphragm Valve

Also Pipe, Valves, Specialties for Heating, Water Works, Fire Protection and Pulp and Paper Mills.

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Company.....
Address.....
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The Sky's His Limit Under the Best Postwar Plan

Freedom is not given a people by a benevolent Government—it is something we must work to *get* and work to *keep*. Freedom of Enterprise has made America the world's most powerful and prosperous nation in both peace and war. Here we have the highest wages paid in the world, here we have developed the highest standard of living. Here we have not been subject to the repressions of a state-controlled economy, but have been free to develop individualism and self-reliance. Let's keep it that way.

We believe our returning soldiers will prefer a job with private industry where the "Sky Is the Limit" for their advancement—in direct proportion to their individual initiative, skill, and ability. Our system of Free Enterprise makes this possible, for it creates the vast volume of American production so necessary to attain and maintain high levels of employment.

In planning for the future, what can be more vital than to combat many plans that seek to abandon the system that has made this possible—Free Enterprise. Continuance of Free Enterprise, plus native American industrial skill and ability, will avoid the gaunt spectre of mass unemployment after the War.

But—unless we are willing to trade the time-proven Free Enterprise system for some substitute which will nullify individual initiative, progress, and freedom, we must speak up. We must explain its principles and advantages to those who may not understand them, because appreciation comes only from knowledge and understanding. If we fail to do this, the failure will be ours.

CURTIS

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1995 Kienlen Avenue St. Louis, Mo.
Air Compressors • Air Hoists • Air Cylinders

jolts and jars. Table height can be adjusted from 24 to 40 inches. Style B-1 has a table capacity of 3000 pounds and will handle dies up to 40 inches long. Style B-2 has a capacity of 2000 pounds and will handle 32-in. length dies. Table is mounted on casters, which can be equipped with wheel brakes. Barrett-Cravens Co., 2350 W. 30th St., Chicago.

Stack Exhauster

Wolverine stack exhauster is designed to convert any roof ventilator into a power fan exhaust unit. It can also be used similarly for horizontal duct systems or for new installations. Installation in existing roof ventilator is made by removal of

ventilator head, insertion of Wolverine stack exhauster on base, and recapping with ventilator head.

The manufacturer explains that the rated capacities are little affected by whatever ventilator head is combined with it. Exhauster is constructed of heavy-gage steel, and has an inspection door for cleaning and lubrication of motor and propeller. Motor is of ball-bearing, totally enclosed, fan-duty type. Belanger-Fan & Blower Co., 1243 18th St., Detroit 16.

Degreaser

Degreasing and cleaning medium, known as Penetone, contains neither carbon tetrachloride nor trichlorethylene, which are on the critical materials list. Besides its availability, the makers of Penetone claim that it presents no fire hazards and is harmless to operators, because it does not throw off obnoxious fumes irritating to mucous membrane nor is it injurious to the skin. In three forms, Standard Penetone for degreasing jobs where the lighter types of greases and oils are used and for general maintenance; Penetone Senior, a stronger concentrate for use on heavy oils and caked-on grease; and Penetone Major for heavy-duty degreasing that requires an extremely potent preparation. Can be used for cleaning floors under machinery and for chassis and wheels of trucks. The Penetone Co., Tenafly, N. J.

THE SIGN OF THE DODGE TRANSMISSIONEER

WHAT IS TRANSMISSIONEERING?

Transmissioneering is a Dodge engineering technique starting with a study of practical production engineering requirements and resulting in "The Right Drive for Every Job." It is the connecting link between power source and production machine.

Transmissioneering involves the component parts of power drives — bearings — pulleys — sheaves, clutches, etc., each transmissioneered to meet definite service conditions and the assembling of these parts to provide effective drive units.

Dodge transmissioneers in industrial centers provide on the job tranmissioneering and a wide selection of Dodge transmissioneered products available from stock. Call your local Dodge transmissioneer — he will show you how to put *all* your power in the job.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana, U. S. A.

BUY MORE WAR BONDS

The Sign of the Dodge Transmissioneer
"Transmissioneering starts with the study of Practical Production Engineering requirements and stops with the Right Drive for Every Job."

DODGE

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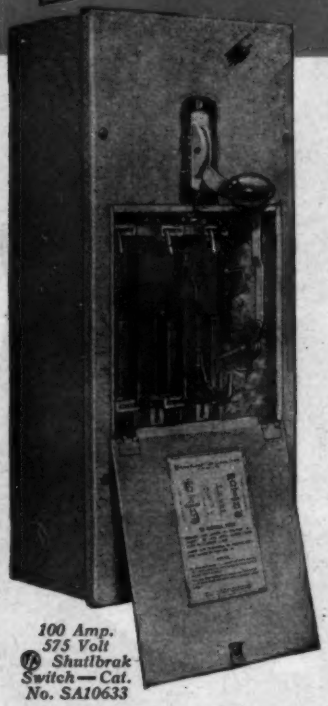
• • • THE RIGHT DRIVE FOR EVERY JOB

~~DANGER~~ SAFETY— with a capital "S"



100 Amp. 575 Volt (FA) Shutlbrak Switch — Cat. No. SA10633

SAFETY IS THE PRIME FACTOR IN THE DESIGN AND CONSTRUCTION OF

(FA) SHUTLBRAK SWITCHBOARDS and PANELBOARDS

Protection against contact with live parts is assured. The switching mechanisms are completely enclosed. The door of each Type A unit has an interlocking arrangement which prevents it being opened when the switch is "on." When the door is open, the current is "off"— thus eliminating the danger element.

Unit construction of (FA) Shutlbrak Switchboards makes expansion of facilities easy and economical. End walls are removable, for placing additional panel sections at either or both sides. Ample size pull boxes are integral with each section.

In each unit, the roller type main contact and auxiliary contacts are enclosed in an insulated shuttle. Shuttle assembly is entirely surrounded by insulating material.

• • •

There is an arc-resisting barrier *at all times* between the line and load contacts.

• • •

(FA) Kamklamp fuse-holders assure copper-to-copper connection *under strong compression.*

• • •

Properly engineered springs insure quick make and quick break.

• • •

All current-carrying parts are silver plated for low resistance.

• • •

(FA) Pressure type (Solderless) Connectors make possible quick, sure connections. There is ample wiring space at top, bottom *and rear* of switching mechanism.

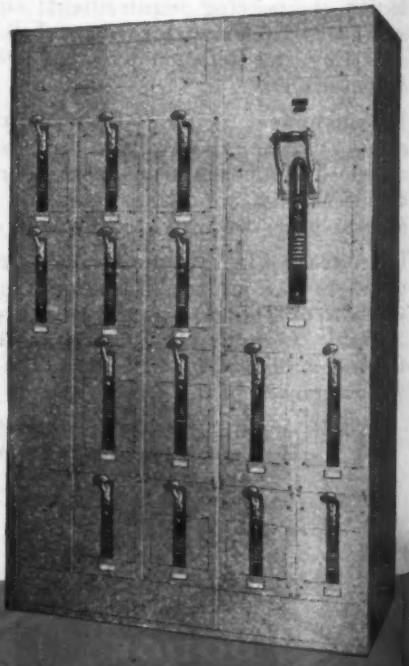
• • •

***Unit capacities:* 30 to 1200 amperes, inclusive, for 250 volts AC or DC, and 575 volts AC, in 2, 3 and 4 pole types.**

• • •

(FA) Shutlbrak Switches are approved by Underwriters' Laboratories, Inc.

The same units are used in the assembly of (FA) Shutlbrak Feeder Distribution and Power Panelboards, enclosed in steel cabinet, with door. Ideal for commercial installations, schools, institutions, etc.



(FA) Shattbruk Dead Front Safety Type Switchboard

For detailed information

and suggested specifications for (FA) Shutlbrak Switches, Switchboards and Panelboards, write for illustrated Bulletin 70 . . . Frank Adam Electric Co., Box 357, St. Louis, Mo.

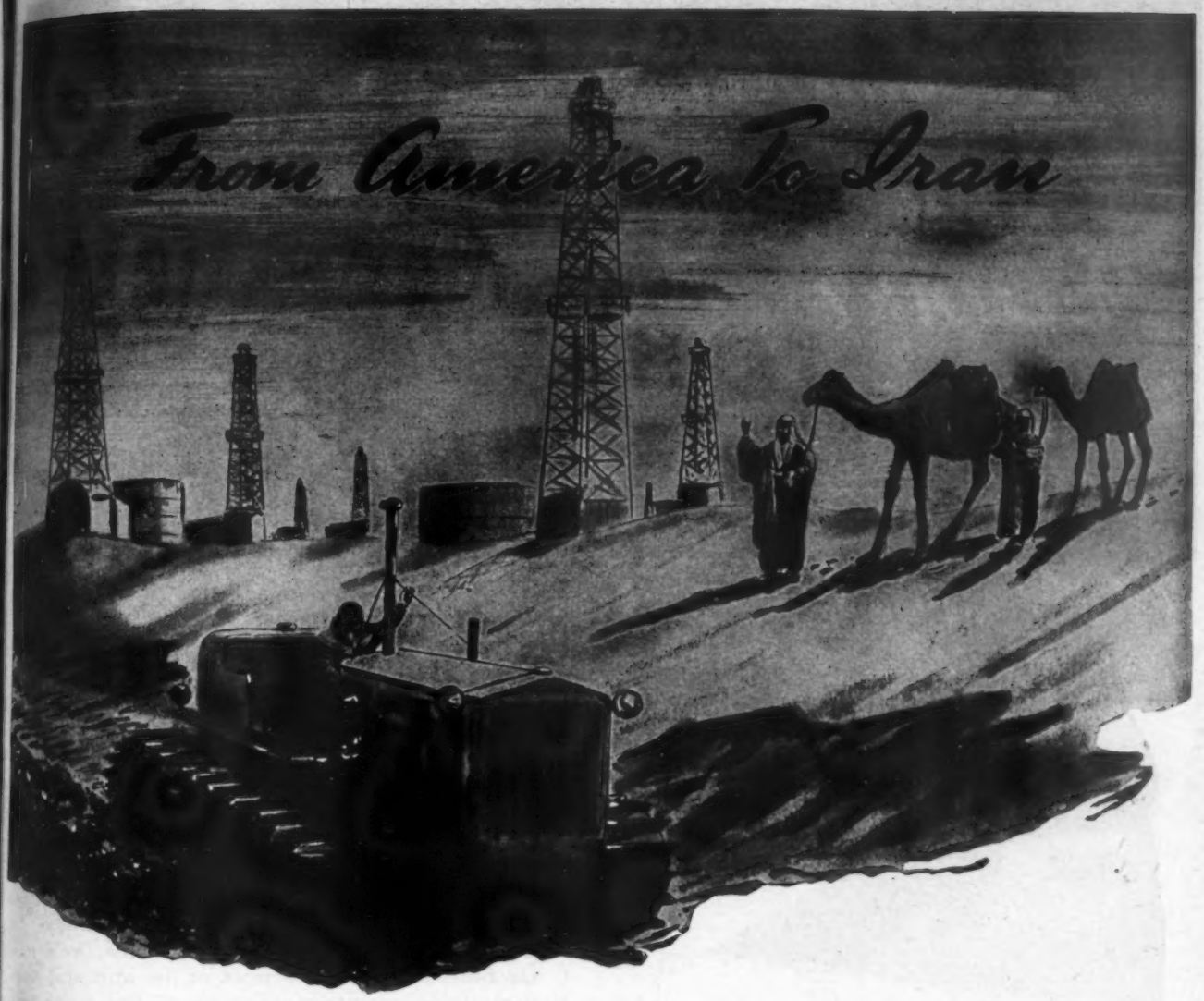
EST. 1891 — THE SIGN OF A BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.



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Manufacturers of:

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PORTABLE STRAIGHTENER FOR KELLYS AND PIPE

Crude petroleum stocks are being rapidly depleted by war. New reserves of oil must be discovered and developed if we are to gain a complete victory over our enemies, and to prepare for the postwar period that will follow.

Rodgers Hydraulic Presses for the Petroleum Industry will enable drilling contractors to dismantle heavy equipment, transfer and reassemble it at a new location after each well is drilled. *If it's a Rodgers, it's the best in Hydraulics.* Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minn.

Rodgers HYDRAULIC Inc.

YOU CAN LEARN PLENTY FROM THIS MILITARY SECRET!

Read how assembly was simplified to get speed... with security

The "inside story" of this war-essential electronics apparatus cannot be revealed because it would aid the enemy. But, there's no secret about the method used by the maker to avoid assembly difficulties, and get fastening speed with security.

Twenty-eight metal and plastic assemblies are made with P-K Self-tapping Screws. Only one easy operation is required . . . the Screws are driven into plain, untapped holes.

The maker, The Langevin Co., New York, says: "If P-K Self-tapping Screws weren't available, we'd have to tap holes for machine screws, or use nuts and bolts. Both methods present serious problems. To tap properly, both parts would have to be aligned within close limits . . . a tough, expensive job. With P-K Screws, we can allow much more tolerance in alignment.

"Since we cannot reach inside to run on nuts, complete re-design of the unit would be necessary to use bolts."

SOLVED... Five Metal and Plastic Fastening Problems

1 Six P-K Hex Head Self-tapping Cap Screws fasten plastic terminal board to transformer and bell.

2 Four P-K Hex Head Cap Screws attach plastic terminal plug to metal bracket. On opposite end (not shown) four P-K Type "Z" Screws make similar fastening.

3 Four P-K Hex Head Cap Screws fasten two canvas-backed plastic resistor strips to a metal bracket inside same part.

4 Eight P-K Type "Z" Screws fasten two canvas-backed plastic resistor strips to 22 gauge metal brackets on amplifier chassis.

5 Two P-K Type "U" Drive Screws fasten nameplate to the product.

Try this SIMPLER Method...

No matter what metal or plastic you use, try the simple, Self-tapping Screw method. In 7 out of 10 cases you'll find you can eliminate tapping, and fumbling with bolts and nuts; do away with inserts in plastics, or cut out riveting or welding in hard-to-reach places.

Call in a P-K Assembly Engineer to check over your fastening jobs with you. Or, mail assembly details for recommendations. Parker-Kalon Corporation, 196-200 Varick Street, New York 14, New York.

SELF-TAPPING SCREWS FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON

Quality-Controlled

SELF-TAPPING SCREWS

This is the 6TH *in a series of messages*

DEALING WITH THE PROBLEMS IN HEAT INSULATION FACED BY ENGINEERS AND SOLVED BY USING UNIBESTOS

6a THE PROBLEM
Insulating large pipes (12" to 60")
6b THE SOLUTION
Use Unibestos in ½ sections from 12" to 30" and in ¼ sections up to 60". These large size sections of Unibestos provide an unbroken surface which results in lowered heat loss — higher efficiency.

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Monitor

The Original JUST PRESS A BUTTON System

Yesterday · Today · Tomorrow

Since 1888 . . . when Monitor engineers introduced automatic electric motor control to industry through the medium of the Automatic Direct-Current Motor Starter..."firsts" have become a habit with Monitor. The solenoid-magnet starter, the belt driven starter, pre-set speed automatic motor control, the Monitor Thermaload Starter—only a few of many Monitor "firsts"—have played their part in the growth of two of America's achievements . . . our mass-production system and our standard of living.

Other "firsts" are on their way . . . to be used as standard equipment and to become integral parts of the custom-built control panels that Monitor will be called upon to build in tomorrow's automatic age.

Monitor Automatic Motor Controls and Equipment can be furnished to meet every motor control problem. Consult the Monitor engineer in your locality.

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AUTOMATIC MOTOR CONTROL

... it pays dividends in performance

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WASHINGTON, D. C.
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VACUUM AT War WORK

Omaha Public Library
Reference Dept.

INVINCIBLE VACUUM EQUIPMENT *may solve your problem!*

IN almost every industry, Invincible portable, heavy-duty vacuum equipment is solving production problems by removing litter, conveying or reclaiming material, and collecting hazardous matter. A few interesting Invincible applications are described below. They may be of direct help to you, or suggest uses for Invincible equipment to solve some of your production problems.

AIRCRAFT—Invincibles remove litter, grindings, nuts, rivets, etc., from otherwise inaccessible recesses of assembled wings, fuselages and tailpieces.

SHIPBUILDING—Invincibles remove water and litter from ship hulls under conditions where the litter prevents use of sump pumps.

WELDING—Working along with automatic welding heads, Invincibles salvage abrasive unfused welding flux, thus reducing costs and saving time.

MUNITIONS—Invincibles reclaim the finest particles of dangerous explosives. These units are valuable in any industrial operation involving hazardous or toxic material.

★ ★ ★

Over 100,000 Invincible Industrial Vacuum Machines are now in use. More than half of America's leading manufacturers use these units which are available in a complete range of heavy-duty models.

Without obligation, an Invincible engineer will consult with you about the use of our equipment.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

FOR 35 YEARS, LEADERS IN INDUSTRIAL VACUUM EQUIPMENT

Memo
for Post-War Production

LOOK TO
Adeco
FOR FABRICATION OF PRECISION PARTS and ASSEMBLIES

Here is a dependable source of supply with the experience, engineering skill and complete facilities for all types of close tolerance production.

ADECO
AIRCRAFT & DIESEL EQUIPMENT CORPORATION
4401 North Ravenswood Avenue,
Chicago 40, Illinois
"Your Partners in Production"

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• "HEALTH OF THE PRODUCTION FRONT" reviews types of medical service in the plant, including control of communicable disease and prevention of industrial diseases. Working environment and the related subjects of rehabilitation, recreation, and morale, are discussed. A check list is provided so each company can score its own industrial health practice. National Association of Manufacturers, 14 W. 49th St., New York 20.

• PLASTIC CASING, used to prepare metal parts for export shipping, is said to withstand the attacks of salt air, salt water, high humidity, heat-cold extremes, abrasion, and other severe hazards of wartime shipping. It can be stripped off in a few seconds by slitting it from top to bottom with a pocket knife. Japan Co., 5103 Lakeside Ave., Cleveland.

• "WINGS IN RECORD TIME," a British Ministry of Information film, is a pictorial record of how the workers at a certain aircraft factory in the northwest of England assembled a Wellington bomber in 24 hours and 48 minutes, on their own time. The film is available for use in industrial plants. For terms, write Universal Pictures, 1250 Sixth Ave., New York.

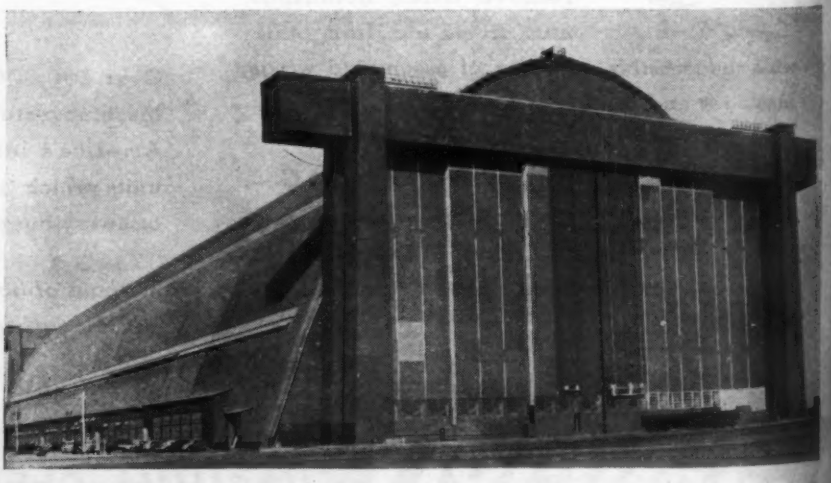
• POST-WAR INTERNATIONAL air transport policy formulated by the U. S. government, is outlined in a pamphlet. Recommendations submitted by domestic airlines include: (1) Free competition, (2) private ownership, (3) fostering of a worldwide system by the U. S. government, (4) freedom of transit, (5) acquisition of civil and commercial outlets required in the public interest. Airlines Committee for United States Air Policy, 923 16th St., N. W., Washington, D. C.

• MASS DEVELOPMENT of 35-mm. photo fluorographic X-ray equipment adds a weapon to the fight against chest and pulmonary diseases. The 35-mm. apparatus is used for survey work only, results indicating the present condition of the subject. If necessary, a subsequent diagnosis is made from a 14x17 film. This procedure saves time and cost, the manufacturers claim. Westinghouse Electric & Mfg. Co., East Pittsburgh.

• A LABOR-MANAGEMENT PLAN for full post-war employment without WPA is advanced in a booklet. The plan, based on partial tax reduction for firms expanding payroll, is outlined with a full explanation of how it operates. A suggested draft of law is included. Pertinent questions are answered. Monroe and Martha Shakespeare, Shakespeare Co., Kalamazoo, Mich.

• PUBLIC TRANSIT—Booklet Number 4 in the War Plant Employee Transportation Series points out problems facing public transit, and outlines steps war plants should take to meet the situation. National Association of Manufacturers, 14 W. 49th St., New York 20.

• ELECTRIC EYE that can see otherwise invisible gases and vapors, has been developed to warn against dangerous concentrations of these compounds in the atmosphere of manufacturing plants. It is claimed that the instrument, known as an ultra-violet photometer, gives direct and



FLAME-PROOFING PROCESS employing a combination of phosphate, sulphate, and boron chemicals is designed to make plywood non-flammable. The plywood is fabricated, impregnated in heavy steel cylinders under vacuum pressure, and thoroughly dried. Originators of the process claim that the treated plywood will take any good grade of paint. American Lumber & Treating Co., 33 South Michigan Ave., Chicago

Compressor Shutdowns "Get the Air"

SOLNUS OILS

Prevent Carbon and Gum . . . Keep Air Compressor "On the Job"

A steady, dependable supply of compressed air is essential to top-rate production in any machine shop. And reliable compressor performance depends to a great degree on proper lubrication.

Frequent compressor shutdowns were a serious problem to a New Jersey manufacturer of roller bearings. The lubricant being used allowed carbon and gum deposits to accumulate so rapidly on the rings and valves of his compressor that it had to be shut down for cleaning every two or three weeks. The result — less production, lost man-hours, higher costs.

Solnus solved the problem. Today, fifteen months after the former lubricant was replaced by Solnus Oils, not a single shutdown of this compressor due to carbon or gum deposits has been necessary. Thus, once again, Sun has helped eliminate a handicap to vital war production.

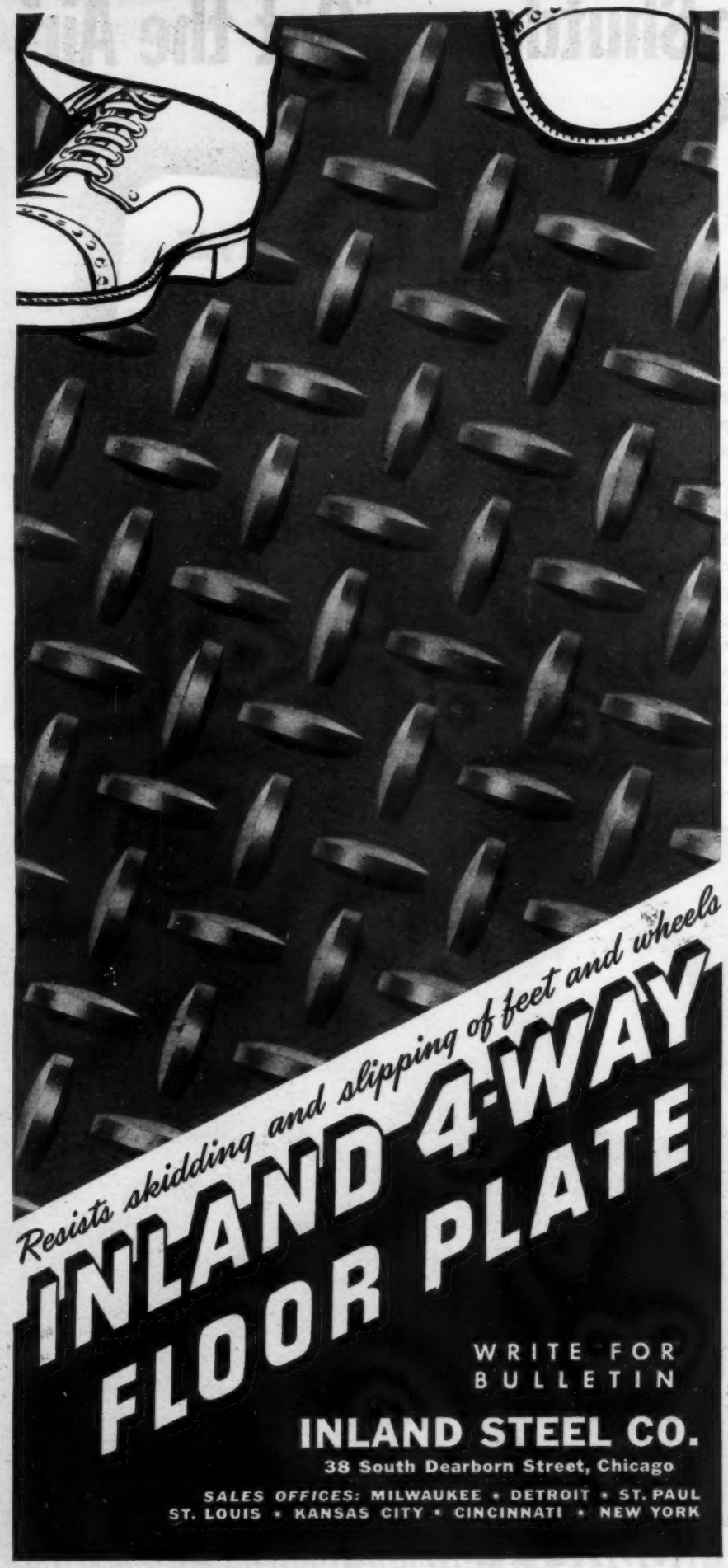
You may boost your production by taking advantage of the knowledge and broad experience of a Sun Lubrication Engineer. Let him show you how the right Sun Lubricant in the right place often means higher production, longer machine life, and more profitable operation. Just write to . . .

SUN OIL COMPANY · ***Philadelphia 3, Pa.***

Sun Oil Company, Ltd., Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS HELPING INDUSTRY HELP AMERICA


Resists skidding and slipping of feet and wheels
INLAND 4-WAY
FLOOR PLATE
WRITE FOR
BULLETIN
INLAND STEEL CO.
38 South Dearborn Street, Chicago
SALES OFFICES: MILWAUKEE • DETROIT • ST. PAUL
ST. LOUIS • KANSAS CITY • CINCINNATI • NEW YORK

instantaneous readings, and is so sensitive that it can detect one part of carbon disulfide in a million parts of air. E. I. duPont de Nemours & Co., Inc., Wilmington 98.

HEAD COVERING protects hair from moving machinery, dust, oil, and dirt. Safety snood is washable, simple in construction, and designed to protect vital parts of the head, scalp line, temples. Once hair is tucked in and strings tied in back, the cap stays firmly in place. Par Mfg. Co., 20 E. Jackson Blvd., Chicago 4

• SURVEY of company morale is a questionnaire to determine the worker's attitude toward his job—his boss, his general surroundings, and the work itself. Opportunity is given for just criticisms to be made anonymously. Available for $4 for 100 copies. The Psychological Corp., 522 Fifth Avenue, New York.

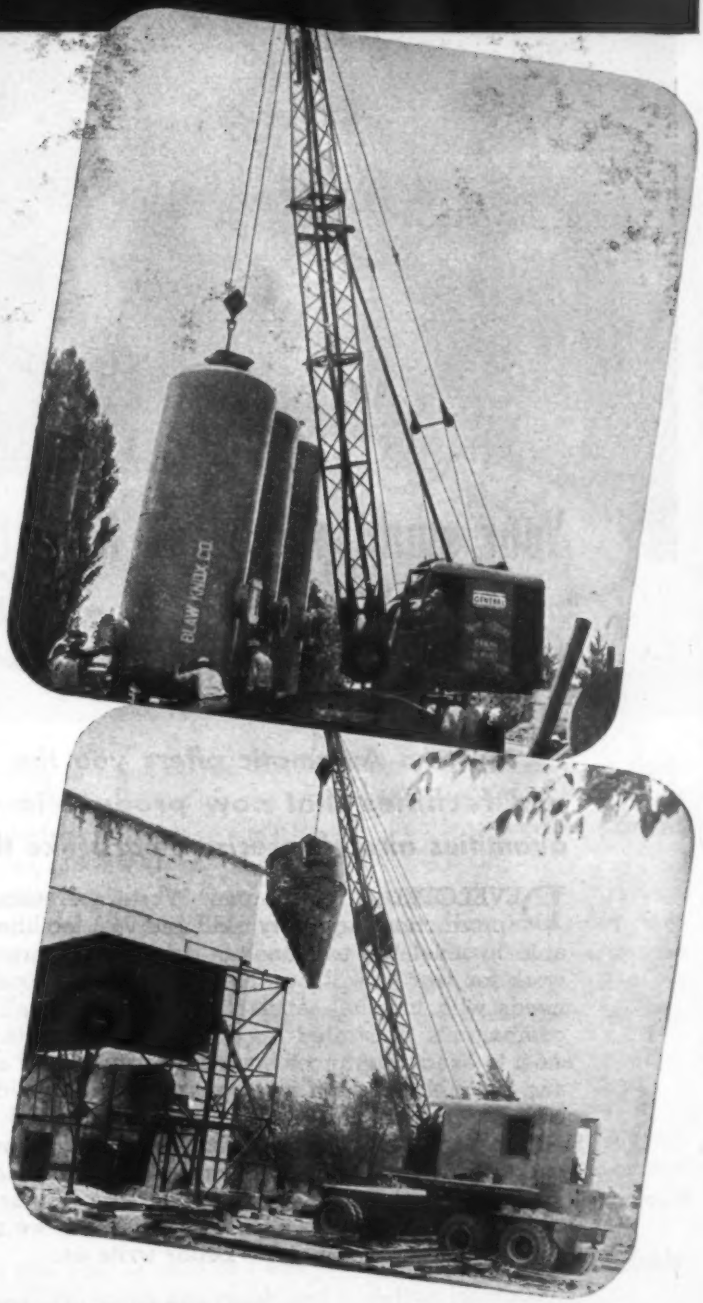
TRANSPARENT aprons, smocks, and sleeve guards of flexible vinyl resin can be worn to protect workers' hair and clothing from becoming saturated with oils or solvents, one of the direct causes of dermatitis. Resisto-flex Corp., Belleville, N. J.

• LIST OF STANDARDS in engineering and industrial fields, representing general agreement of maker, seller, and user groups

Mobility · Speed · Power

SUPERCRANES AND MOBILCRANES . . . pack the power—plus the speed and mobility—so necessary for efficient loading, moving, stacking and unloading operations in the metal-working and metal-producing industries. Moving materials with one-engine-powered, one-man-operated cranes conserves vital time and fuel . . . fully utilizes manpower, reduces handling expense. Furthermore, cranes equipped with pneumatic tires will not damage floors, runways or loading docks —require no tracks or rails.

Supercranes and Mobilcranes (pioneered by General Excavator and Osgood respectively and now in world-wide military use) are designed as complete units from tires to boom-tip—not merely cranes mounted on trucks. And because they are complete units, produced by one manufacturer, every approved and modern feature is incorporated. Because they are built from the ground up for the job they have to do, there's never a sacrifice in design or material, never a compromise affecting dependability. Write for full information now—be ready when the booms swing to post-Victory work!



ONE-MAN CONTROLLED • ONE-ENGINE OPERATED • RUBBER-TIRED

THE OSGOOD CO.
MARION, OHIO
MOBILCRANES

THE GENERAL EXCAVATOR CO.
MARION, OHIO
SUPERCRANES

Your small parts can have this Life-and-Death *Precision*

... Western Automatic offers you the skill and facilities that now produce in war quantities aircraft precision parts like these

DEVELOPED in peace-time, Western Automatic's production ingenuity, skill and vast facilities are able to meet the tremendous demands of precision work for war — will be able to serve your post-war needs with unusual satisfaction. The two small vital components illustrated above are made of stainless steel to exact tolerances that assure freedom of action and so finely finished as to guarantee against corrosion by the fluids to which they are subjected. One important fact for you is that manufacturing controls and step-by-step inspections make complex precision work like this possible on a quantity basis. This service is yours tomorrow — we're busy today but we might be able to help you now — better write us.

Western Automatic
Machine Screw Company
Elyria, Ohio, U. S. A.

Precision Screw Products, Parts and Assemblies Since 1873

as to the best current industrial practice, has recently been published. Specifications for materials, methods of tests, dimensions, definitions of technical terms, and procedure are given. War materials standards are listed separately. Prices included. American Standards Assn., 29 W. 39th St., New York 18.

• A SOLUTION to the problem of removing gummed paper from plastic glass sheets and formed parts is offered. A chemical compound called Turco Gummed Paper Remover safely removes masking paper, according to the manufacturer. Plastic sheets and formed parts are simply soaked in a tank full of the compound until the gummed paper is loosened enough to peel off. Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1.

• DATA SHEET shows a rod washer specifically designed to salvage and reclaim scrap welding rods. Continuous 24-hour service is claimed for this machine, which has a frame of all-welded construction, and is equipped with two sets of baskets. A standard model is available, or designs and blueprints can be obtained by firms desiring to build their own. Aufhauser Brothers Co., 295 Madison Ave., New York.

• SOUND MOTION PICTURES telling the story of aluminum are described in a booklet published by the Motion Picture Department, Aluminum Company of America, 801 Gulf Building, Pittsburgh 19, Pa. Topics covered include aluminum fabricating processes and metal working techniques. Information is included on how to get pictures, and how to put on a show. Educational booklets, and visual aids including machining chart, a welding and brazing chart, and a global map, are listed. Films are available for 16-mm. and 35-mm. projectors.

PROCESS FOR REMOVAL of overspray from spray-painting operations consists of brushing spray booth coating on the conveyor parts before painting begins. Over-spray which ordinarily would have to be scraped off can easily be stripped off in sheets, according to the manufacturer. Harris Soap Co., 18 Stetson St., Buffalo 6, N. Y.

I am a CLARK FORK TRUCK

A Product of **CLARK EQUIPMENT COMPANY**

I work 24 hours a day, at home or overseas . . . wherever free men are fighting. I am always behind the lines handling the supplies that keep them fighting.

Our fighting men need all the supplies I handle now . . . I am working full time with our armed-forces to speed Victory.

But, I haven't forgotten the job I am able to do at home.

You can get me to work for you . . . thousands more of my family (we have over 60 members) will soon be available to feed your production lines . . . to save time — to save manpower — to lower costs, that more of your products, whatever they may be, will be available sooner, because I handle everything from the raw to the finished products.

I can work in the factory, yards, warehouse or on the docks.

I handle loads of 1000 to 7000 lbs. like they are as light as ducks' down.

The men and women who control me never know fatigue. . . . I do the work. At the slightest urging I am on my way, looking for material to carry, stack or tier. I save plenty of floor space too, by stacking material to the ceiling, and you should see how easy I do it.

Don't forget, like I told you, as soon as I can, when more like me are available, I'll be ready to help you. I'm tough and rough and a glutton for work.

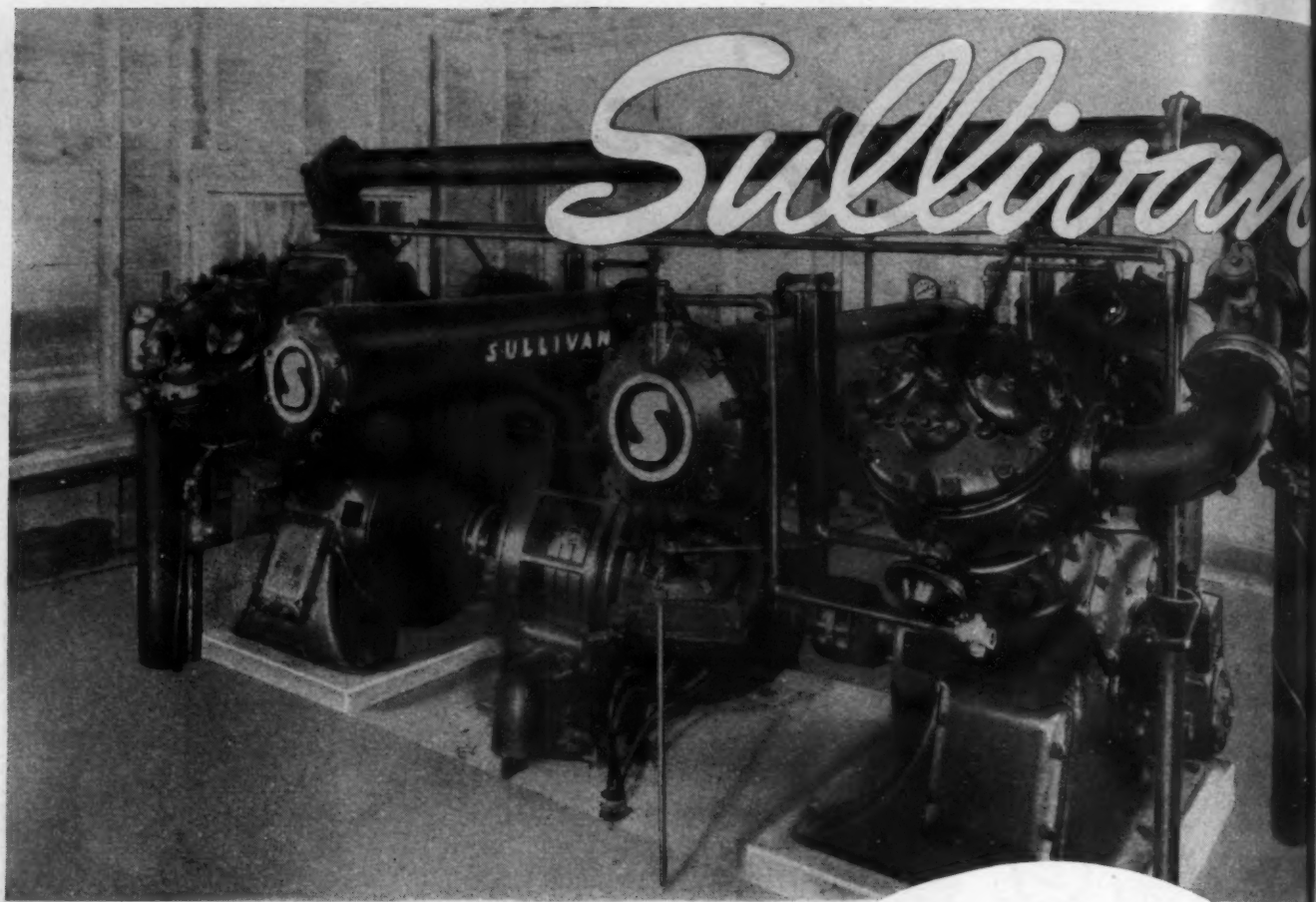
Sincerely, *Clark Fork Truck*

P. S. I was built by the Men of Clark and they are a fine lot of Craftsmen.

CLARK TRUCTRACTOR

DIVISION OF CLARK EQUIPMENT COMPANY

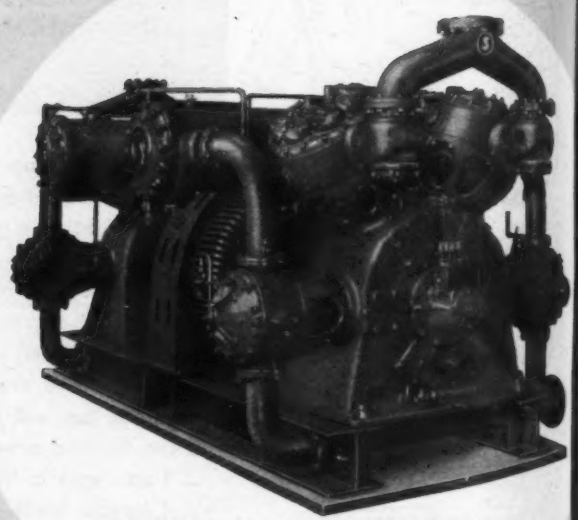
BATTLE CREEK, MICHIGAN, U. S. A.



Twin Installation of two Sullivan WN-112 Series 100 Compressors and synchronous motor. Gives flexibility for all load conditions and standby insurance.

TEN GOOD RULES for Air Compressor Lubrication

1. Double acting compressor cylinders should be lubricated by means of *visible flow* force-feed lubricators.
2. Highest quality air-cylinder oil should be used in adequate but not excessive quantities.
3. Determine proper amount of lubrication by examination of the compressor valves. All parts should have a definite oil film thereon. If they feel dry the lubrication is inadequate. If the oil film is too heavy, or if excessive carbon deposits are evident, lubrication is excessive.
4. Crankcase oil-sump should have an external oil-level indicator. If force-feed lubrication is used, should also have a pressure gauge in the system to indicate oil pressure.
5. Crankcase oil should be maintained at proper level and periodically replaced by a good lubricating oil.
6. Thoroughly clean all sludge and old oil from crankcase oil-sump when changing to new oil.
7. Obtain definite recommendations from reputable refiners as to proper type and viscosity of oil for both crankcase and air-cylinder lubrication.
8. Prevent contamination of oil in storage by keeping it tightly covered and avoiding contact with harmful substances and dirty containers.
9. Inspect and regularly clean all screens and filters in the lubricating system.
10. Periodically check, while in operation, the oil pressure, rate of cylinder lubrication and any other external indicators of proper lubrication.



A Twin Installation of two WN-114 Heavy Duty Compressors in a great steel mill. Compressors run in tandem or singly, operate at peak efficiency and conserve power.

ASK FOR CATALOG No. A-52

SULLIVAN
AIR COMPRESSORS

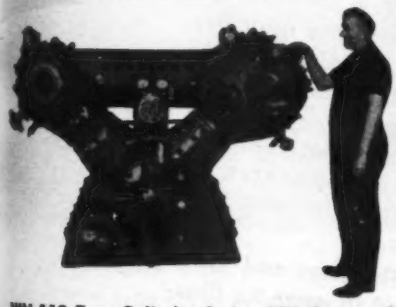
Twin Compressor Units

Flexible, Economical and Efficient Means of Meeting Widely Varying Air Demands

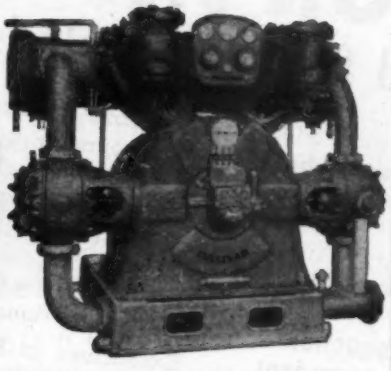
FOR utmost efficiency in meeting widely varying air demands, investigate the flexible, economical and compact Sullivan Twin Air Compressor Units. A Twin Compressor Unit consists of two Sullivan Series 100 Compressors driven by a single synchronous motor or turbine speed reducer set with a double-ended shaft. Each compressor is easily connected or disconnected by means of a flexible coupling. Thus, during periods of peak demand, you can operate both compressors. During periods of lesser demand, you simply disconnect one compressor.

Plants anticipating future expansion or requiring above-normal power-factor-corrective KVA can purchase one half a Twin Unit now and add the second half when increased demand warrants it.

The Sullivan Series 100 Compressors are extremely compact when used in twin combinations. The unit requires only a simple concrete foundation. The economy of a single prime mover is obvious. The twin compressor idea, pioneered by Sullivan 20 years ago, is especially advantageous now when every possible economy must be practiced and efficiency maintained at a peak . . . when America's factories are her battle line and must stand unyieldingly in place. Sullivan Compressors are built by workers every one of whom knows how much depends on their unfailing performance.



WN-112 Two Cylinder Series 100 Compressor, 378 to 1828 C.F.M. Maximum space requirements: 8 feet long, 6 feet 8 inches wide; foundation 4 feet 2 inches long; 2 feet 11 inches wide.



WN-114 Four Cylinder Series 100 Compressor made in 4 sizes, in single and twin units. 175 to 600 h.p. 1092 to 3656 C.F.M. Floor space 9 feet x 10 feet. Foundation 5 feet x 8 feet.

Sullivan SERIES 100 COMPRESSORS

are two-stage, double acting, long-lived, heavy duty, continuous service compressors—much more compact than old style compressors of the same capacity—and yet have operating economies exceeding those of the older bulky units of the same capacity. Series 100 Compressors need only to be hooked up to power, water and air lines and they are ready for 24-hour per day constant and efficient service. They are particularly suitable for synchronous motor drive and extremely well adapted for drive from steam turbines or diesel engines.

Write for reprints of this chart in Poster form . . . printed in red, white and blue, 18 x 24 to hang in your plant.

SULLIVAN MACHINERY COMPANY

Executive Offices: MICHIGAN CITY, INDIANA

FACTORIES: MICHIGAN CITY, IND. • CLAREMONT, N. H. • DUNDAS, ONT. • GRANTHAM, ENG.

In Canada: Canadian Sullivan Machinery Company, Ltd., Dundas, Ontario

OFFICES

BOSTON - - - 104 Brookline Ave.
CHICAGO - 307 No. Michigan Ave.
NEW YORK - - - - 30 Church St.
PITTSBURGH - - 47 Terminal Way
ST. LOUIS - - - - 2639 Locust St.
SAN FRANCISCO - - 145 10th St.
LOS ANGELES - 2900 Santa Fe Ave.
DETROIT - 2051 W. LaFayette Ave.

Birmingham, Butte, Dallas, Denver, Duluth, El Paso, Huntington, Knoxville, Scranton, Salt Lake City

PRODUCTS

HEAVY DUTY, SINGLE OR TWO STAGE STATIONARY AIR COMPRESSORS IN ANGLE, V-VERTICAL, VERTICAL OR HORIZONTAL TYPES IN SIZES FROM ¼ TO 3000 H. P. ALSO A COMPLETE LINE OF PORTABLE COMPRESSORS

100% Visibility

VISION SYSTEMS
spotlight the record facts for analysis and action!

VISION speeds record keeping and brings the required information before you in proper form, so that you will be able to make quick, correct decisions and take prompt action. VISION Record Systems are invaluable for

PURCHASE—INVENTORY—PRODUCTION—PERSONNEL—AND ALL CONTROL RECORDS

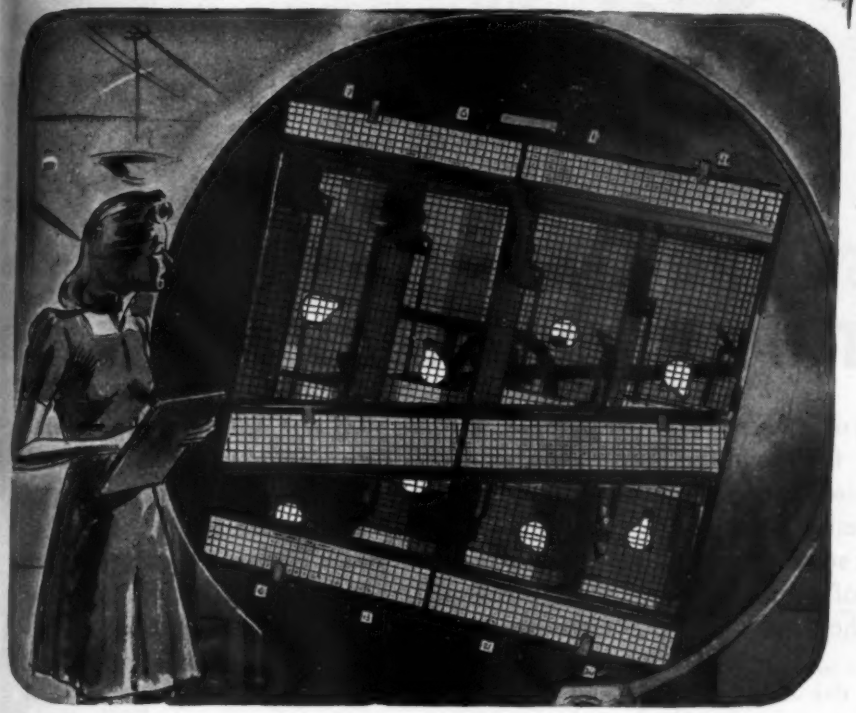
Through the use of signals and charting on the visible portion of the cards, records become active graphic charts of your activities as they move from one phase to another. Trends are recognized—enabling Management to maintain positive control of Men—Materials—Machines and Money. No matter how exacting or unusual your record requirements may be, Acme's sound and practical knowledge gained through years of experience, *specializing in record systems exclusively*, will materially aid you to VISUALIZE AND REALIZE ON YOUR RECORD FACTS to save time and get more done.

Executives in Business and Government are invited to write for illustrated booklet "VISION." Also other valuable informative literature . . . PRODUCTION CONTROL RECORDS Booklet #417...WAR RECORDS (various kinds) "MANUAL of 304 'Use-Tested' ACME WAR RECORDS." A request on your letterhead will receive personal, prompt attention.

ACME VISIBLE RECORDS, INC.
122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

This girl gets PAID to bounce G-E bulbs downstairs!

1. **Bouncing lamp bulbs** downstairs isn't a practice we recommend. But in G-E's lighting laboratory there's a machine specially built to give lamp bulbs the punishment they'd get if you *were* to bounce them down a flight of stairs.



2. **This is it . . .** a big revolving drum with eight compartments that bounce the bulbs from heights of six to 30 inches. Main object is to test strength of lamp filaments. They aren't special lamps—just ordinary G-E bulbs. Filaments of the surviving lamps are carefully examined after each bounce.

"TO MAKE LAMPS STAY BRIGHTER LONGER"
The Creed of G-E RESEARCH

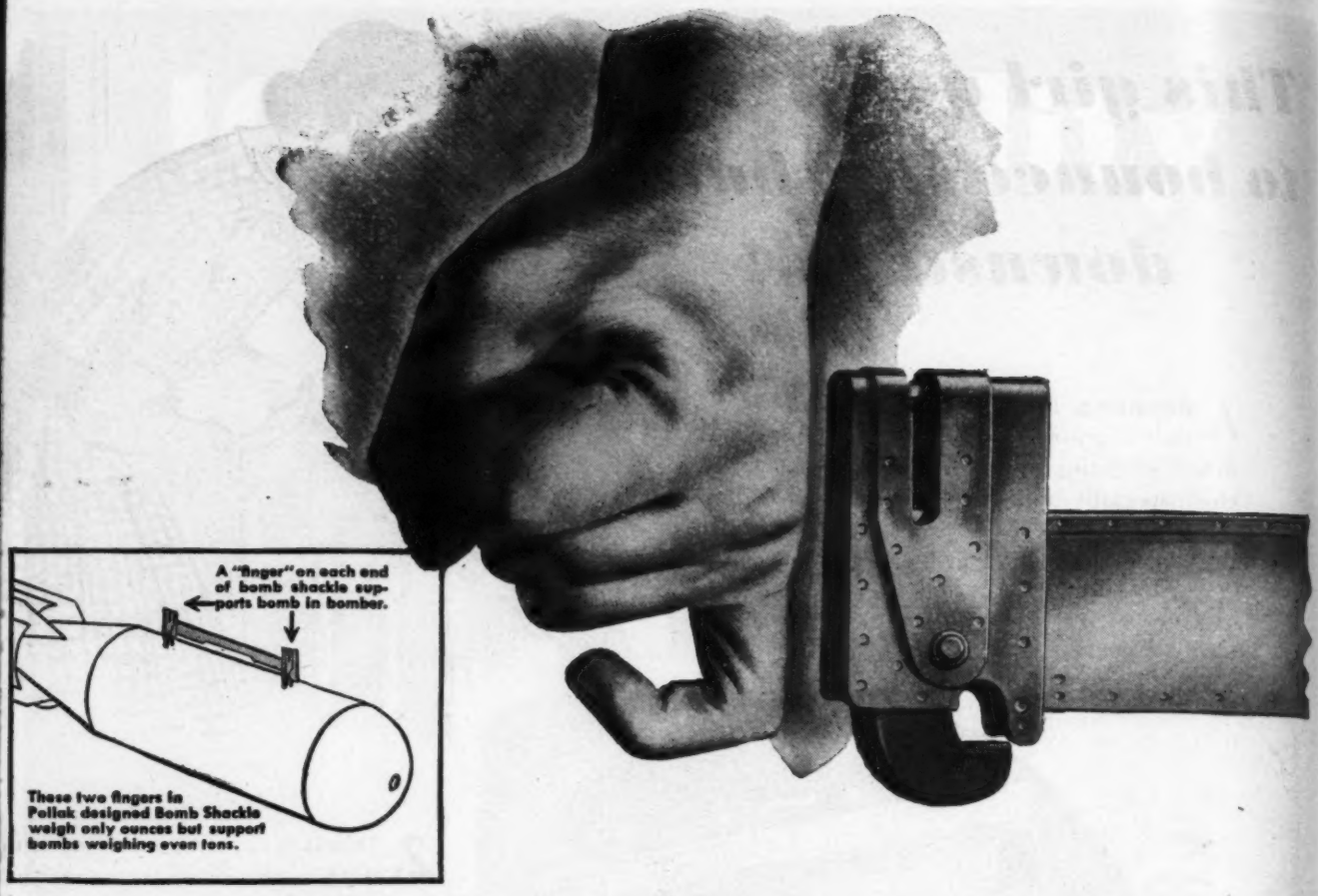
3. **This is only one** of more than 480 tests and inspections given to standard G-E Mazda lamp bulbs. Why all this bother? Simply to insure uniform high quality in every lamp wearing the G-E monogram, whether a special lamp for war or the G-E lamps you use in your plant.

BUY AN EXTRA WAR BOND NOW!

G-E MAZDA LAMPS

GENERAL ELECTRIC

Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.


A "finger" on each end of bomb shackle supports bomb in bomber.
These two fingers in Pollak designed Bomb Shackle weigh only ounces but support bombs weighing even tons.

EVER SEE THE LITTLE FINGER THAT HOLDS A BOMB?

THERE ARE TWO OF THEM. One on each end of the bomb shackle that supports the bomb in the bomber. These fingers, weighing only a few ounces, carry the weight of bombs weighing many hundreds of pounds. In split second timing with the bomb sight, in all kinds of weather and temperatures, they must release the bomb automatically—precisely—instantly.

Pollak was given contracts by the Army and the Navy to manufacture these all-important bomb shackles, bomb racks, smoke screen generators, fuzes and other precision devices. In record time we organized a large, modern equipped plant to produce and deliver this war materiel. How well we are doing this job is indicated by the Navy having awarded the Pollak Manufacturing Company the Army-Navy "E" and four stars.

This award indicates Pollak's ability and capacity to produce precision products in large quantities and deliver them on time.

Some day, when peace is won and our own war work is finished, this proven ability of Pollak to engineer, develop and manufacture products that are designed and made right—produced in volume and delivered on time—may be of great value to your business.

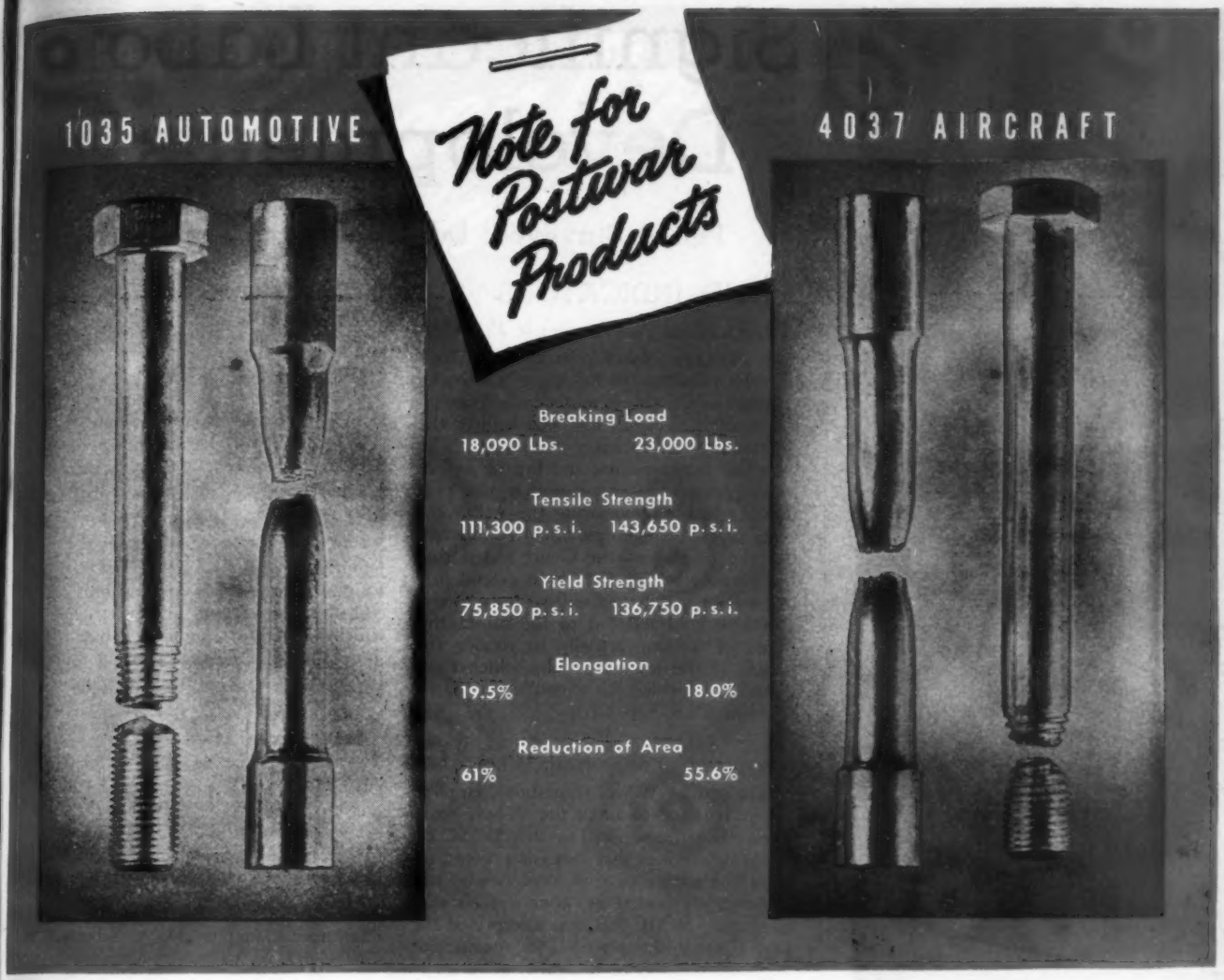
Now, while you are planning for peacetime products, we suggest that you plan with us. We will be glad to meet with you at your convenience.

POLLAK
PRECISION
PRODUCTS

Five Army-Navy "E" awards—the Flag and Four Stars—each of which symbolizes six months of Exacting Service to our Armed Forces, have been awarded to Pollak.

POLLAK MANUFACTURING COMPANY · ARLINGTON, NEW JERSEY

DEVELOPING · DESIGNING · FABRICATING · STAMPING · SPINNING · WELDING · FINISHING · MACHINE WORK



HOW AIRCRAFT STEEL HAS INCREASED *FASTENING STRENGTH*

Prior to the war, 1035 steel was considered about top-notch quality for a bolt—the standard for automotive use. Some bolts and cap screws were made of 2330 (high nickel steel) or 3135 (chrome nickel steel) but these were regarded as high priced specialties.

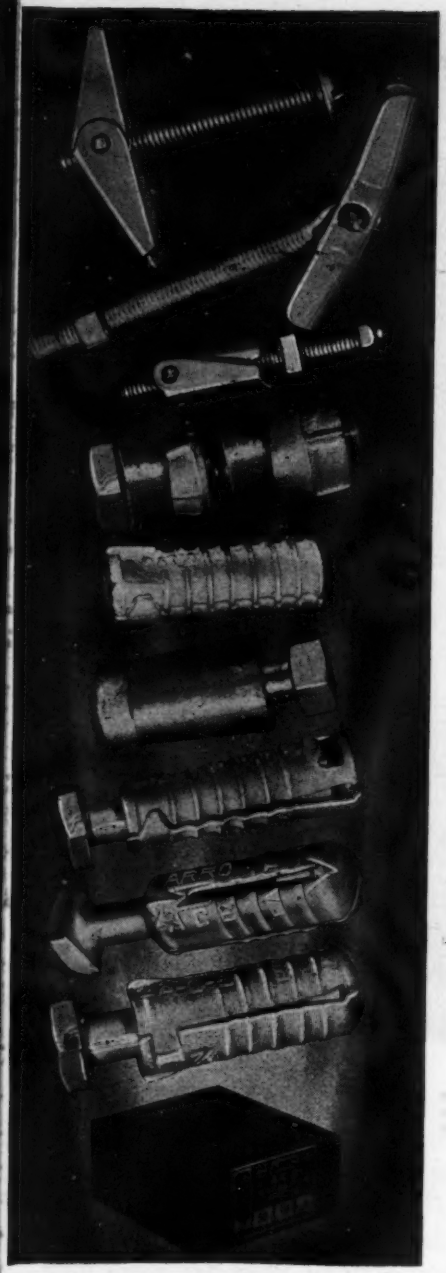
War needs for aircraft required better fastenings in huge quantities, and scarcity of alloys forced the use of newly developed "emergency" steels, particularly 4037.

This steel has been amazingly successful, both in performance and in its qualities for fabrication into tough fastenings. It gives physicals at least equivalent to those found in more expensive, harder working, higher alloy steels.

As shown above, 4037 is much stronger than 1035 steel, but it is not a great deal more expensive. It means better postwar fastenings in automotive and many other important applications.

National
HEADED AND THREADED PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.



YOUR JOBBER HAS AMPLE STOCKS ON HAND FOR IMMEDIATE DELIVERY

TRADE ARRO MARK

EXPANSION BOLTS
AND ALLIED PRODUCTS

Sold Only Through Distributors

Significant Labor Developments

Period Surveyed: December 10 to January 10

TREND INDICATORS

Anti-Kickback Act Applies to Foremen

THE FEDERAL Anti-Kickback Act, which provides penalties for forcing a "kickback" of wages by employees on federally financed construction projects, has been held by the Supreme Court to apply to foremen who have the power to hire and fire, as well as to employers. In denying that the only person capable of violating the Act is the other party to the employment contract,—i.e., the employer—the Court stated that the purpose of the Act "is to extend protection not merely to the legal form of employment contracts but to the substantive rights of workers actually to receive the benefit of the wage schedules which Congress has provided for them." (U. S. vs. Laudam, U. S. Sup. Ct.)

Interpretation of 48-Hour Week

Under current WMC regulations, employers are required to adopt the 48-hour work week when the regional or area WMC director determines that extension would involve the release only of workers who can be promptly placed in other suitable employment. WMC has now interpreted the term "promptly placed" to mean, not necessarily that suitable jobs are actually open, but merely that there is a reasonable expectation that the released workers will be suitably employed within a short time.

The term "suitable employment" is interpreted to mean employment at standard wages and working conditions in the same or related occupation as the job from which the worker would be released.

No Sex Distinction in Seniority

WLB has ruled that where work is similar in some operations there is sufficient ground for eliminating a distinction between men and women in claims for jobs based on length of service. (Westinghouse Air Brake Company, WLB)

Held Not Under the Wage-Hour Law

Building service workers employed by a company engaged in the sale and distribution of milk and milk products on a national and international scale, where the actual production of goods for commerce was carried on in buildings separated entirely from the building in question, and the activities of the employees were not so closely related to the movement of commerce as to be a part of it. (Borella vs. The Borden Co., USDC-SD, N. Y.)

Truck drivers employed by a wholesaler to make local deliveries of petroleum products imported from other states and stored in a bulk storage tank of the manufacturer, since the products came to rest within the state. (Daly vs. Citrin-Kolb Oil Company, USDC-ED, N. Y.)

Watchmen employed to guard the construction of a plant to be used in the manufacture of small arms ammunition, since the operations of the watchmen were not vital to the manufacture of the munitions. (Noonan vs. Fruco Construction Company, CCA-8)

Records to Justify Deductions

Employers must now keep records on the cost of board, lodging, or other facilities for which deductions are made. These records must include itemized accounts showing the nature and amount of any expenses involved in the computation of the reasonable cost of the facilities supplied.

Waiver Upheld

A federal district court reversed a state supreme court ruling in holding that employees who have signed releases waiving claims for liquidated damages upon receiving overtime compensation may not afterwards sue for further penalty payments. (Salvatore Gangi vs. D. A. Schulte, Inc., USDC-SD, N. Y.)

Interest on Liquidated Damages

A New York federal district court amended an earlier judgment to award a group of employees interest on liquidated damages which they recovered in a wage suit brought under the Wage-Hour Act.

Although the employer argued that the Act does not provide for interest upon liquidated damages, the court ruled that the question of interest is a matter of local law, and the failure to include interest in a judgment may be corrected as an oversight or an omission. (Rigopoulos vs. Kervan, USDC-SD, N. Y.)

Scope of Blacklist Penalty

The blacklist penalty for violation of the Walsh-Healey Act was extended to cover both a prime contractor and his substitute manufacturer, as well as the individual owners of the firm, barring all of them from participating in government contracts for three years. Liquidated damages were also assessed for employing a female minor under 18 on government work.

Blacklist Penalty Waived

The blacklist penalty was suspended in the case of two firms found guilty of violating the Walsh-Healey Act. However, both companies were ordered to correct certain conditions and to pay liquidated damages.

(Continued on page 220)

CLEANS FLOORS

Seventeen Times Faster

Here is mechanical equipment to bridge the gap of unavailable man-power in connection with floor cleaning. Here is a *Finnell* Scrubber-Drier capable of doing seventeen man-hours' work in one! Makes possible the maintenance of clean floors—so essential to worker health and safety—notwithstanding today's critical man-power shortage, and regardless of the vastness of the floor area.

As a matter of fact, this self-powered *titan of the floorways* was designed expressly for use in war plants whose vast areas involve miles of floor cleaning. Scrubbing and drying in one operation, this *Finnell* has a cleaning capacity up to 15,000 sq. ft. an hour! Absence of power lines leaves the machine free to go wherever the operator guides it. Contour of the machine provides for maximum clearance. Powerful 'V' type squeegee.

For free floor survey, consultation, or literature, phone or write nearest *Finnell* branch or Finnell System, Inc., 2502 East Street, Elkhart, Indiana.

★ *Let's All Back the Attack — With War Bonds*

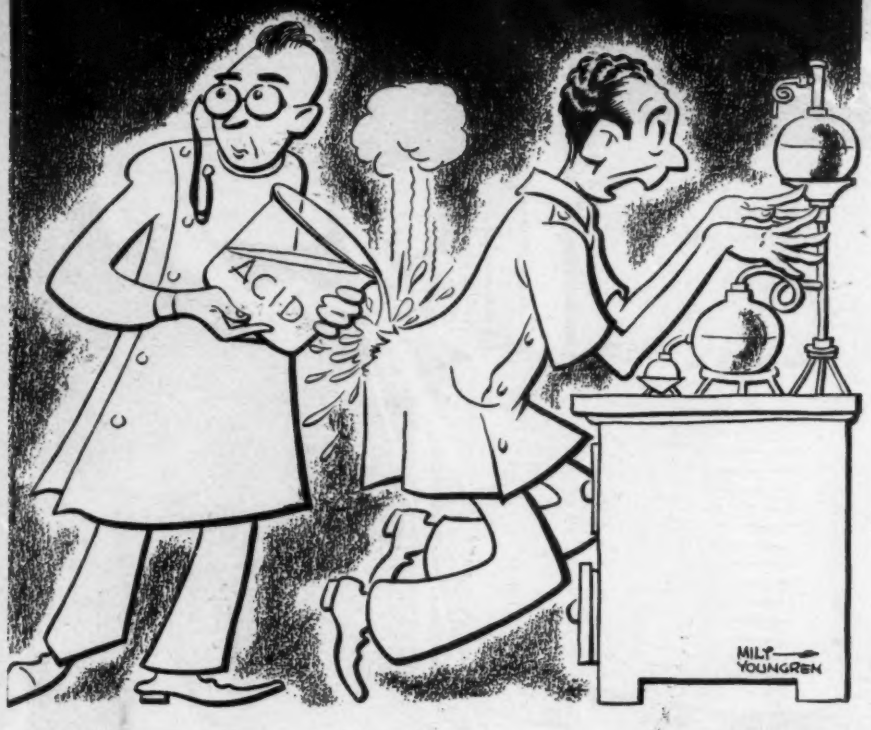
FINNELL SYSTEM, INC.

Pioneers and Specialists in

FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES

BRANCHES IN ALL PRINCIPAL CITIES

ACID RESISTANCE!

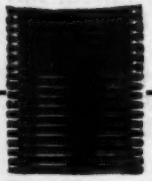


REX-FLEX Stainless Steel Flexible Tubing Is *Non-Corrosive*

REX-FLEX Stainless Steel Flexible Tubing was designed by Chicago Metal Hose Corporation to meet exacting military requirements. Its proved ability to successfully handle many types of corrosive gases and liquids and to withstand extreme heat, makes REX-FLEX equally desirable for the solution of *your* corrosion problems.

REX-FLEX is available in five wall forms, braided or unbraided. Fittings are resistance seam-welded to form uni-metal assemblies.

Why not take advantage of the experience of Chicago Metal Hose Corporation's engineers in adapting this versatile product to the wide range of problems requiring the stamina of stainless steel? They will be glad to give you their recommendations, without obligation. Write for complete information today.



REX-FLEX STAINLESS STEEL FLEXIBLE TUBING

Note These Features

- Corrosion resistance
- Extreme flexibility
- Pressure tightness
- Lighter weight
- Withstands extreme temperatures
- High fatigue resistance
- Seam-welded fittings

Flexible Metal Hose for Every Industrial Use

CMH CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

(*Continued from page 218*)

WAR LABOR BOARD

* *Reduced-Price Stock Sales as Salary Raise*

Below market sales of stock to employees who receive dividends thereon constitute salary adjustments which require approval.

In order to obtain approval the employer should show among other things the extra income the employees may expect as a result of the plan, the past earning records of the employees involved, and the primary purpose of the stock purchase.

* *Later Base Date for 15 Percent Formula*

WLB directed the Western Union Telegraph Company to grant to its employees in Detroit, Salt Lake City, and Duluth a wage increase equal to 15 percent of the aggregate rates prevailing in 1943 rather than on the base date of January 1, 1941. The Board justified the use of the 1943 base on the ground that labor turnover had been so great since January 1, 1941, that the use of the earlier date would have resulted in increases averaging less than 15 percent per employee. (Western Union Telegraph Company, WLB)

* *Unstabilizing Increase Reduced*

WLB reduced an award which the Regional Board had granted to employees on the ground that they were necessary to restore previous differentials between their rates and those of employees of other similar firms in the area, which differentials had been upset by recent wage adjustments granted to employees of other firms. Since the adjustments for the other employees were to bring their rates more in line with those paid to the employees involved in the present case, the awarding of the wage increase would merely start another cycle of adjustments, and not, as the Regional Board claimed, constitute the end of a cycle of wage increases to stabilize wages in the industry. (Boston Elevated Railway Company, WLB)

* *Insurance Benefits*

Insurance benefits which need not be considered part of wages or salaries include those in which payment of the premiums is restricted to 5 percent of the employee's annual salary and which are for ordinary or whole life insurance policies which do not provide a cash surrender or loan amounting to a large percentage of the premium paid. This does *not* include premiums on endowment life insurance policies, single premium life insurance, and other similar types.

An employer may not pay premiums upon life insurance policies for the benefit of a small group of selected employees without prior approval. The number of employees for whom benefits on life insurance policies may be paid will be determined by the nature of the business and the total number employed.

* *Uniform Commission Rules*

The WLB's rules governing the payment of commisson to salesmen have now been

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.

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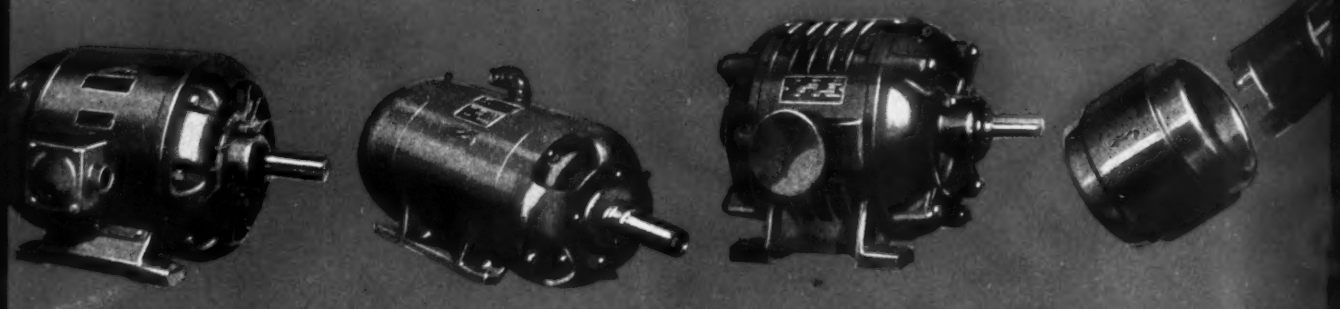


made applicable to commission salesmen subject to the jurisdiction of the Treasury. Under these rules, commission payments may be decreased or increased without prior approval, as long as there is no change in the rate of commission. Any change in the commission rate or any change from a salary to a commission basis does require prior approval.

Application of Going Wage Brackets

Modifying a Regional Board order, the National Board directed a wage increase for a group of employees who had been refused it on the ground that the group was already receiving the minimum of the bracket of going wages for the particular occupation.

NWLB ruled that the going-wage bracket principle may not be allowed to disturb existing plant differentials or to create intraplant inequities. (Portland Traction Company, WLB)

Substandards

WLB awarded a 50-cent hourly minimum rate for experienced workers in the cotton garment industry to correct substandards.

The Board overruled the contentions of a minority of the employers that the correction of substandards should be on an area rather than an industry basis, since consultation with officials of the 12 regional offices convinced it that an industry-wide minimum would have no serious effect on the national wage stabilization program. (Cotton Garment Industry, WLB)

WLB approved a 50-cent hourly minimum to correct substandard wages plus tapered wage raises based on the substandard wage adjustment to 70 cents an hour. (Six Philadelphia leather goods manufacturers, WLB)

* Bonus Not in Violation of Premium Pay Order

Provisions in the contract for the payment of a 5-cent bonus for all hours worked in any work week in which work is performed on the sixth or seventh day, was held not to be in violation of the Premium Pay Order. In allowing such bonus payment the Regional WLB provided, however, that the payment of the bonus is to be discontinued if and when the company reduces its present 48-hour week to a 40-hour week, since such payment would then be in violation of the Premium Pay Order. (American Brass Company, RWLB, N. Y.)

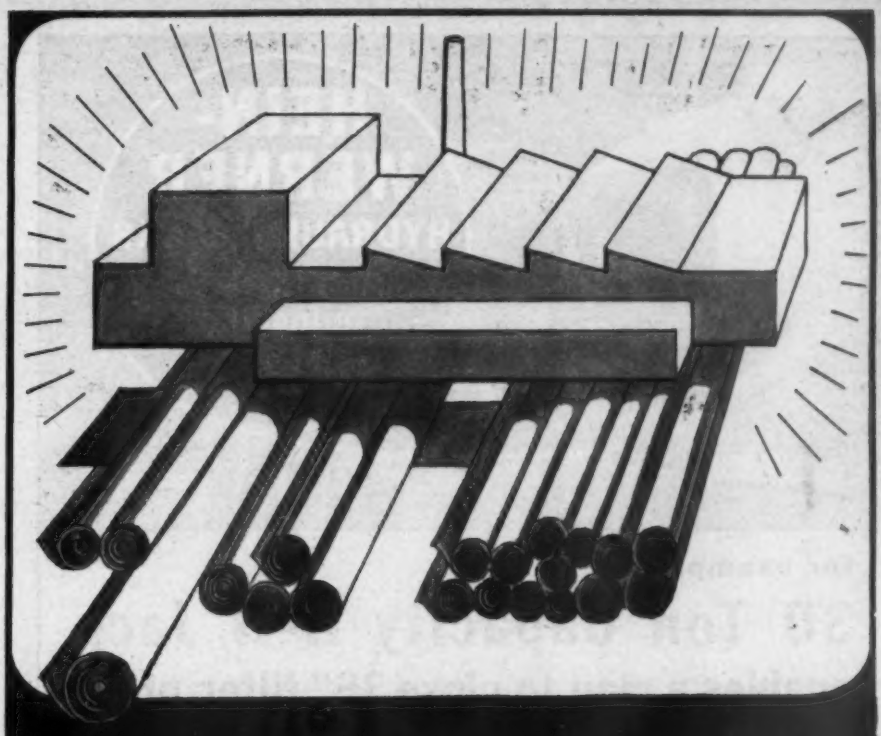
Bonus Allowed

A Regional WLB approved bonus payments of $50 to employees who submitted patentable ideas, since the bonus served as an incentive to increased production and did not appear to constitute a wage increase. (Selas Company, RWLB, Pa.)

A suggestion-box bonus plan was approved whereby employees would receive from $2.50 to $100, retroactive to March, 1943, depending upon the value of the suggestion, since such a bonus would promote greater efficiency and interest upon the part of the employees. (Jacobs Aircraft Engine Company, RWLB-Pa.)

Bonus Disallowed

An increase in a cost-of-living bonus was denied. (Supplee Wills Jones Milk Com-



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pany, RWLB-Pa.) as was a proposal to pay a merchandise award of $2.50 to employees with perfect attendance records. (Specialty Screw Machine Products Company, RWLB-Pa.)

Bonus as Part of Wages

RWLB directed an employer to include in his union contract a Christmas bonus plan which was found to be a part of the firm's wage structure.

The Board ordered the inclusion of this plan to guard against the creation of an inequity through later discontinuance of the customary bonus. (Ideal Cement Company, RWLB-Denver)

Discontinuance of Bonus Permitted

The Regional WLB allowed an employer to discontinue a bonus which had been paid in 1941 and dropped in 1942, on the ground that the bonus was a gratuity and not an integral part of the wage structure. (Best Foods, Inc., RWLB-II)

Incentive Plan Criteria

In considering applications for approval of incentive plans, a Regional Board not only weighed the effect of the proposed plans on production and labor costs but also whether the proposed plan would unstabilize wages in the area, create intraplant inequalities, and penalize absenteeism in direct proportion to the time lost, no more and no less. (Superior Canned Egg., Ebaloy Foundries, RWLB-VI)

Military Severance Pay

WLB set aside a Regional Board order directing the granting of severance pay to employees entering the armed forces. The Board held that this is a matter for collective bargaining. (New Indiana Chair Company, WLB)

Premium Pay for Holidays

In computing premium pay for Christmas and New Year's Day, the first holidays under the Premium Pay Order to fall on Saturday, the following rules apply:

1. Rather than have the beginning and end of a holiday cut across two shifts, the 24-hour period which constitutes the plant's work day may be treated as the holiday instead of the actual midnight-to-midnight period.

2. For purposes of computing the seventh consecutive day of work, the holiday is to be counted as a day worked even though the employee was absent for any cause. The same rule applies for computing the sixth day of work, unless an employment agreement provides to the contrary.

3. Premium rates may not be pyramided. If an employee is entitled to premium pay on one of the holidays on several counts he may be paid only the highest single premium rate applicable to work on that day.

**Holidays Not Worked*

A Regional WLB has in some cases limited compensation for unworked holidays to

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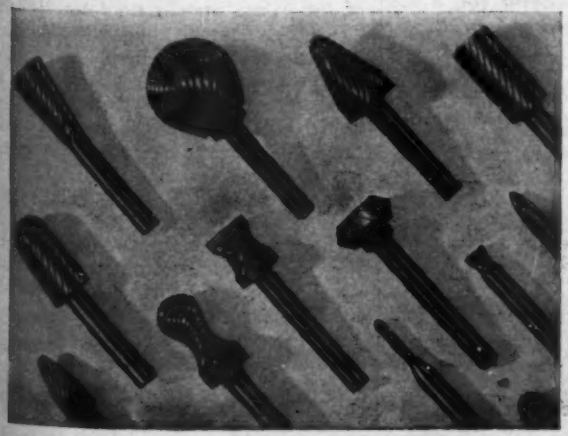

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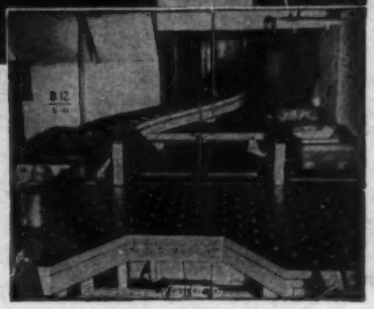

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the holidays on which an employee's department is not operating.

If the employee's department is operating on a designated holiday and he works, he receives time and one-half for the hours so worked but if he chooses not to work that day, he receives no compensation for the day. (Becton-Dickinson & Company, RWLB-N. Y.)

Expediting Critical Wage Cases

WPB and WMC will certify to the WLB those rare and unusual cases whose prompt decision is vital to war production. The WMC will certify those cases where a manpower shortage which threatens production cannot be remedied except by a wage adjustment, while the WPB will furnish information concerning the importance of the particular plant's production to the war effort.

*Enforcement

A Regional WLB recommended that the entire payroll of a company, found guilty of granting approximately $600 in unauthorized pay increases, for the period during which the increases were in effect, be disregarded for income tax purposes, a decision which was affirmed by NWLB. (Parkland Sportswear Company, RWLB-Tex.)

Another Regional WLB ordered that $3936 be disallowed in computing the employer's federal income tax. (White Frost Ice Company, Inc., RWLB-Chicago)

The enforcement division of three Regional Boards found violations of the wage stabilization regulations involving, in one case, illegal wage payments amounting to $24,000. In this and in one other case, the Boards concerned recommended disallowance of approximately one-fourth of the amount illegally paid. In the third case, however, disallowance of the total amount of over $7000 was recommended. (Husky Refining Company, RWLB-Denver; Ace Marine Welding Company, RWLB-N. Y.; Mariani Construction Company, RWLB-Boston)

*Light Penalty for Wage Violation

The Enforcement Division of a Regional Board recommended a mitigated penalty for a company engaged in war production which put into effect a new wage schedule before obtaining Board approval.

Negotiation for new wage rates had begun in September, 1942, and agreement had been reached shortly after the passage of the Wage Stabilization Act, (October 2, 1942). Actual filing for approval on Form 10 was delayed by changes made in the form by the Board. Although the company advised the Board that it would be necessary to adopt the new rates immediately in order to avoid delays in wartime production, it did not receive Board approval until April 2, 1943. The approval was not retroactive.

The Enforcement Division found that the company was confronted with a critical situation because of its relatively low rates, which prevented it from obtaining sufficient labor to fulfill essential government contracts and that its action in putting higher rates into effect without Board approval was necessitated partly because of

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Board delay. (Parker Appliance Company, RWLB-V)

**Criteria for Granting Union Security*

The fact that the union has or has not engaged in a strike is not the sole criterion to be used by the Boston Regional WLB in determining whether union security should be granted or withheld.

Unions requesting the maintenance-of-membership clause must be able to prove that:

1. Management of the company has been "hostile to the union or anti-union in its actions" or

2. A "membership-maintenance clause will improve the existing relations between the company and the union."

If management opposes the grant, it must show:

1. That "the local, district, or international union officials having direct contact with the company are irresponsible, as evidenced by the conduct and actions of its leadership in their dealings with the company, by the union's record and actions on strikes and stoppages, and by the lack of control by its officials over the membership," or

2. That "the existing relationship between the parties will be worsened by a maintenance-of-membership clause", or

3. That the "union's constitution, by-laws, or practices are such as to work a hardship upon the employer and that the nature and past actions of the union's leadership is such that an unjust application of these onerous provisions can be reasonably expected to result." (Shawinigan Resins Corporation, RWLB-Boston)

Standard Union Security Clause Ordered

A membership-maintenance clause providing that each individual employee's consent be obtained before he can be bound by the provision was ordered replaced by the standard clause under which all union members after a given date and those later joining are required to continue members as a condition of employment. (Westinghouse Air Brake Company, WLB)

NATIONAL LABOR RELATIONS BOARD

**Management's Rights*

An arbitrator held that a union's demand for dismissal of a supervisor was unreasonable and not properly the subject of arbitration.

The Board ruled that to permit compulsory arbitration in matters affecting business policies and the direction of personnel would impair the independence of management officials in directing the affairs of the company for which they are responsible. (Wright Aeronautical Corporation)

Held No Discrimination

An employer was not guilty of discrimination in discharging a union steward because of the overzealous performance of his duties —i.e., unduly pressing the management to take up employees' grievances or to arrange

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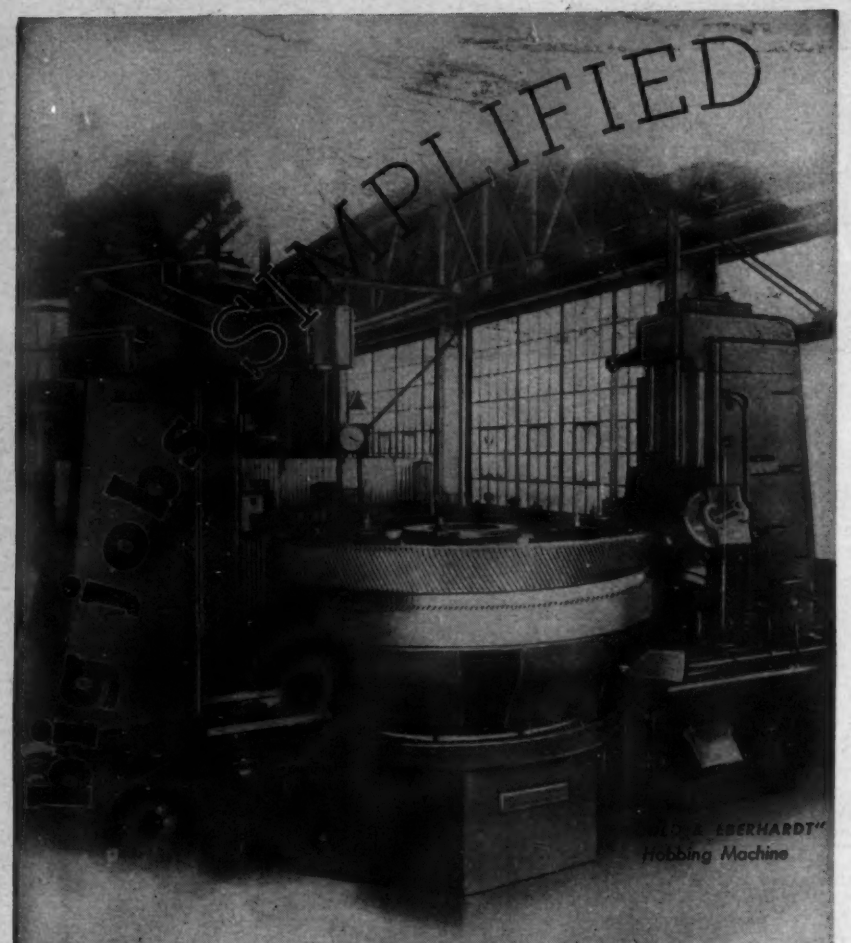

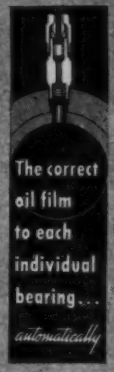

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for meetings and interfering generally with the shop supervisor. (Fred A. Snow Company, NLRB)

Coverage

A firm making steel for ships to be used in war transportation was held subject to the NLRA since such transportation constitutes commerce within the meaning of the law. (New Market Steel Co., Inc., NLRB)

Domination

The fact that a union is certified as bargaining agent is no guaranty against the Labor Relations Board's finding that the employer had been guilty of domination. (Utah Copper Company vs. NLRB, CCA-10)

Discrimination

The discharge of an employee who had been the most active in union affairs in the plant, allegedly for spreading false rumors, was held discriminatory where the employer had made only a superficial investigation of the employee's connection with the alleged rumors. (Simmons Company, NLRB)

**No Penalty for Interference*

New York Supreme Court ruled that while the State Labor Relations Board may prohibit interference with labor's right to organize, it need not require of the company the "humiliating procedure" of posting notices with respect to the violation. (Toffenetti Restaurant Company, N. Y. Sup. Ct.)

**University Directed to Bargain Collectively*

The N. Y. State Supreme Court upheld an order of the State Labor Relations Board directing a university to bargain with the employees of a commercial loft building owned by the university and operated by a commercial corporation. The exemption from the State Labor Act of employees of educational institutions was held not to apply if such institutions were engaged in some commercial business enterprise. (Columbia University vs. NYLRB, N. Y. Sup. Ct.)

**Closed Shop Sustained—at Least for Duration*

Massachusetts Supreme Judicial Court ruled that a closed-shop contract between a union certified as exclusive bargaining representative by NLRB and an employer's association was valid, even though it "greatly" restricted or "practically" destroyed the employment of workers not members of the contracting union. Both federal and state labor acts permit the making of such a contract. (Hamer vs. Nashawena Mills, Inc.)

The California Supreme Court ruled that a state court, at least for the duration, lacks jurisdiction to determine the validity of a closed-shop contract between a union and an employer engaged in interstate commerce, where the WLB had already assumed jurisdiction over a labor dispute involving the contract. (Pearson Candy Company, Ltd. vs. Waits)

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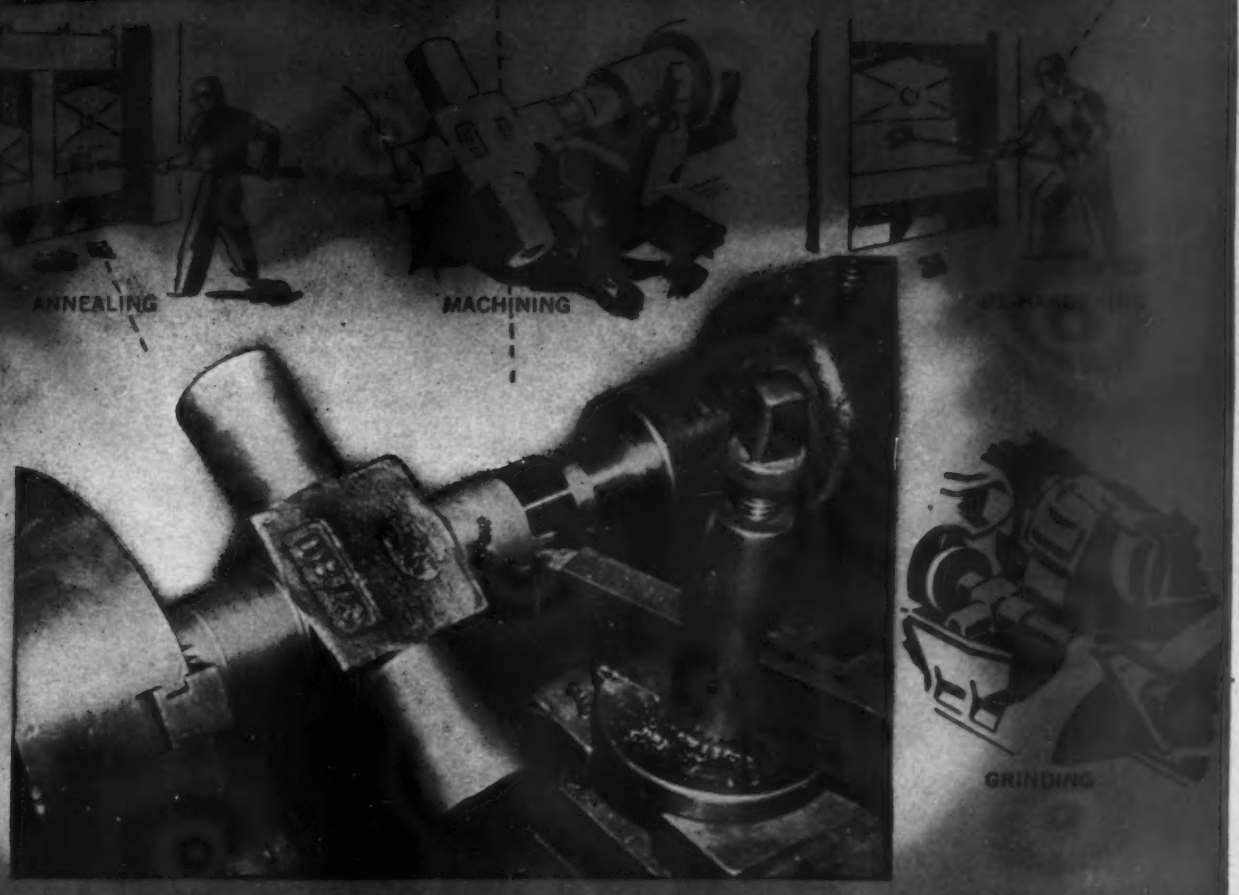

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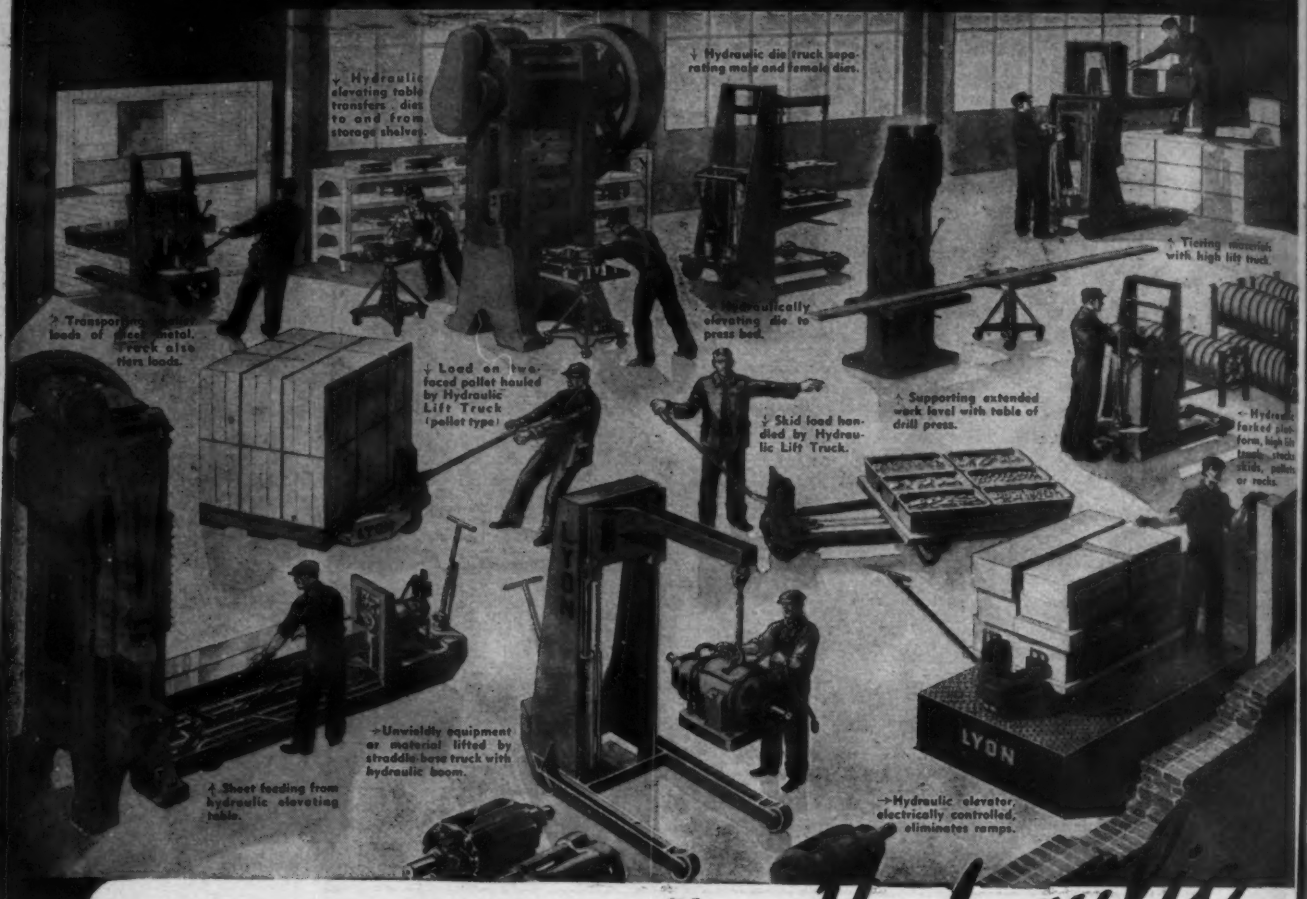
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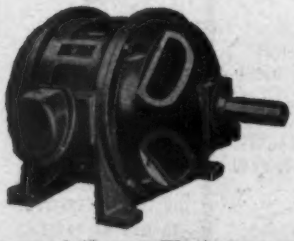

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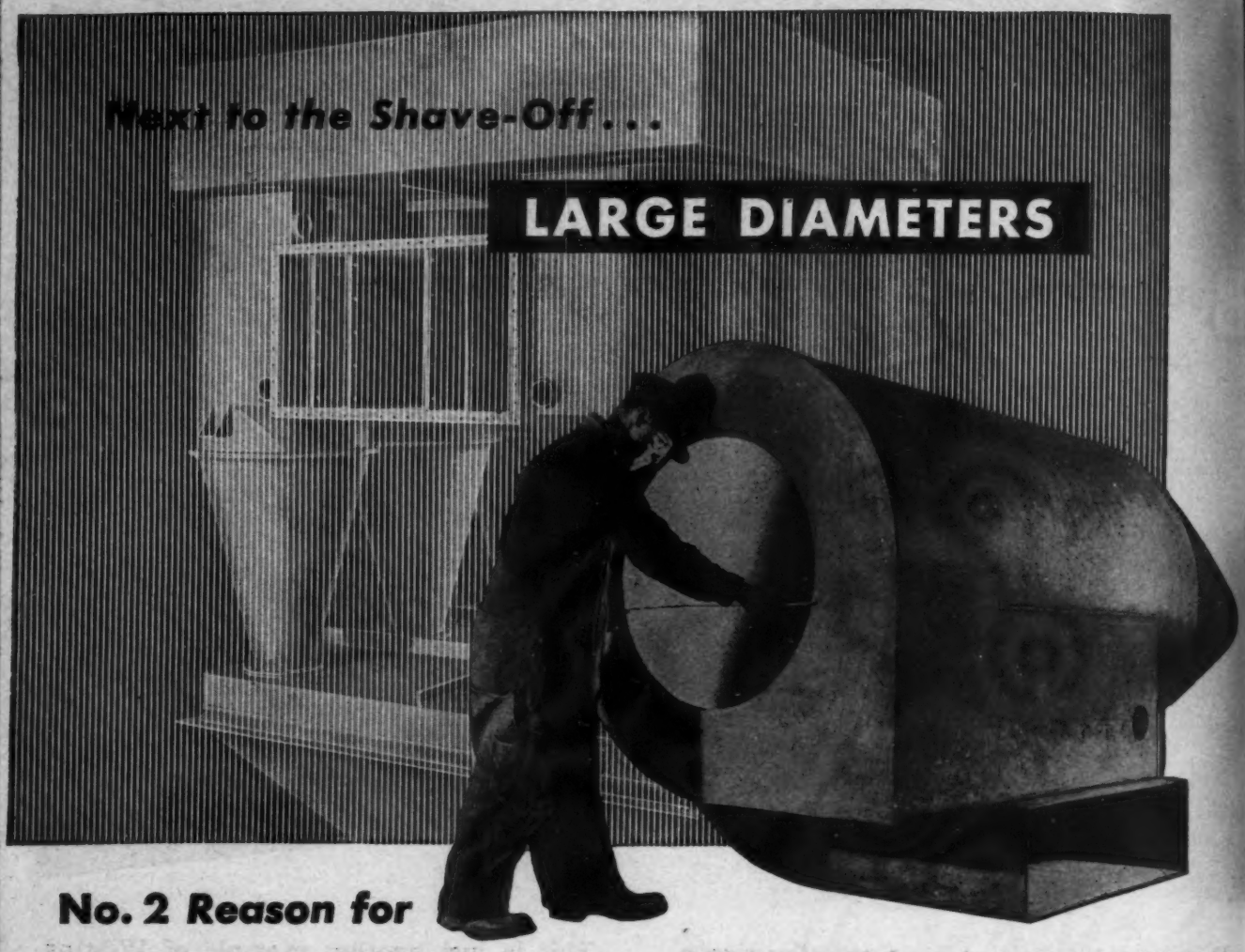

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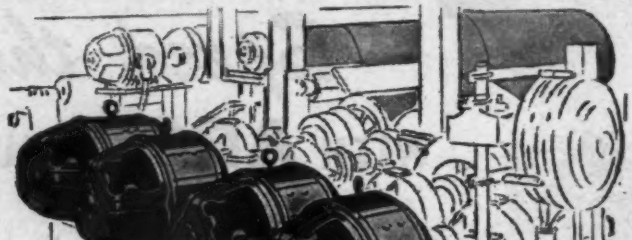

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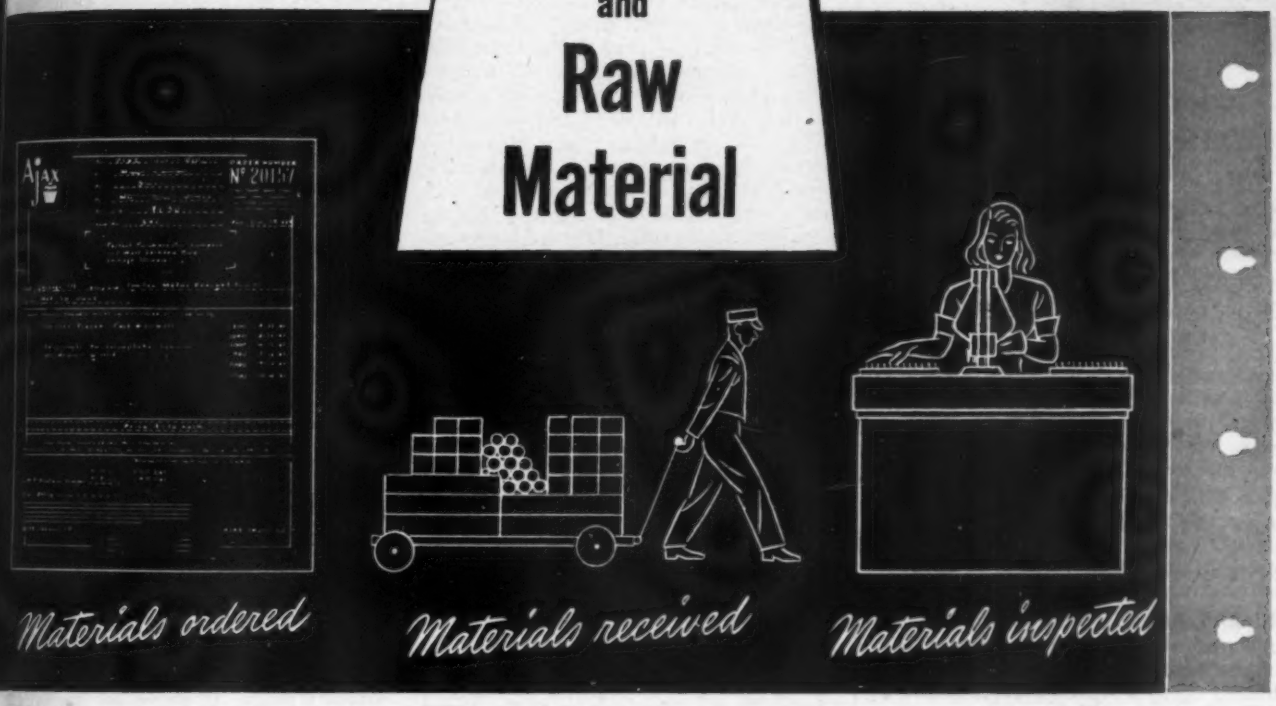

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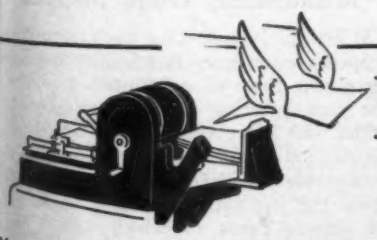

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Summarizing the Current Labor Situation

(For an excellent analysis of the labor situation today, FACTORY *is indebted to the "New York Times," in whose columns for January 8 and 9 respectively the two following editorials appeared.)*

For a Labor Policy

There cannot be the slightest doubt in the mind of anyone capable of five minutes' sustained objective thought that both strikes and threats of strikes in wartime impede our war effort and aid the enemy. A strike that ties up production ties up supplies to the fighting fronts. If it delays victory by a month or a week or a single day it may cost thousands of lives. The mere vote of railway unions here in favor of a nation-wide strike, followed by government seizure of the railroads, must obviously give support to enemy propagandists and to enemy hopes.

All this is undeniable. Yet an amazing situation has developed. The President, in yielding to the rail strike threat as he had yielded in 1941 and as he had yielded to John L. Lewis's strikes, failed to make clear to the rail unions and to the country just what their action meant. General Marshall, who was in a position to know in detail the results of the strikes and threats of strikes, did state the facts about the situation anonymously in a press conference. Mr. Roosevelt's secretary then said, rather obliquely, that the President thought along the same lines himself.

We now come to the payoff. While the government failed to state directly and forcefully the consequences of the threatened railway strike, the rail unions and their champions are not at all shy in denouncing the government for what was said even in this discreet manner, "Why this 'blitz' against rail unions?" ask the very rail unions that did not hesitate to threaten to "blitz" American production. "Why was General Marshall dragged into the rail wage controversy?" they continue—as if the adverse effect of their strike threat on the war was no business of the Chief of Staff. And David Dubinsky of the International Ladies Garment Workers Union, venturing even further, calls General Marshall a "tool" in a "smear campaign against labor." Have the boys overseas been told, he asks, "that the actual number of man-hours lost through strikes amounted to less than a fraction of 1 percent since the war started?" Has Mr. Dubinsky ever been told, one wonders, that the statistics he parades are meaningless? Has he been told that it all depends on where the strike is? The whole soft coal production of the country amounts to only 1 percent of the total national income. If the coal mines were shut down for an entire year by a strike, would Mr. Dubinsky say that the time lost was only 1 percent of the total man-hours worked, and that 99 percent of the work went forward without strikes? What would actually happen, of course, is that all war production would be brought to a complete halt. Have we come to the point where wartime strikes cannot even be deplored by government officials?

That a complete revision of the Administration's labor policy has become imperative should no longer be open to doubt. The general lines of this revision are clear:

1. If the cost of living is to be kept from rising, one requirement is that wage rates, which are the largest single element in prices, should be frozen by the same principles. Labor can no longer be encouraged to believe that wage rates can go on rising and that at the same time the cost of living can be held down. A common formula should be adopted that will apply to all groups of workers without favoritism, discrimination, or, if possible, even the suspicion of them.

2. Overlapping and duplicating wage-fixing agencies and administrators should be reduced to a single top agency. This means, for one thing, that separate and special treatment for rail workers, under a special act of their own, should not be permitted to continue during the war period. The top labor agency ought preferably not to be the tripartite War Labor Board as at present constituted. Where final decisions are involved, to be imposed by governmental authority, those who make them should be "public" representatives solely. This does not mean that labor and employer representatives cannot usefully serve on mediation boards, with advisory powers, subordinate to the top agency. The top agency, however, should not be permitted to set up its own ambiguous, vacillating, or arbitrary policy. It should act primarily as a labor court, to apply to specific cases the wage formula or directive laid down by Congress and the president.

So much for the machinery. But though it is important to have the right machinery, the machinery can be no better than the men of which it is composed or the spirit in which it is applied. We need not only a just labor policy but a firm one. The test of that firmness would come with the first strike threat. If the government surrendered to that strike threat, the new machinery would become as useless as the old. Not until the Administration stands up against a strike threat, and penalizes the strikers instead of the struck-against, will we have a labor policy that commands and secures respect.

Mishandling Wage Disputes

When the President last week reconvened a special emergency fact-finding board to reconsider the still unadjusted dispute of the non-operating railway employees, he added one more turn to the bewildering twists and turns that his railway labor policy has involved. There have been from the beginning two possible courses of action, either of which would have been at least consistent and clear. One would have been for the President, at the

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time of introducing the wage-stabilization program, to have recommended to Congress the suspension for the period of the war of any provisions of the Railway Labor Act that conflicted with that program. Under such a course the War Labor Board would have passed on railway wages as on all other wages. If there had been a simple formula applied without discrimination, all labor would then have felt that it was being treated alike. This is the course we think the President should have taken. The President might, on the other hand, have continued to make railway labor an exception, to retain the Railway Labor Act in its integrity and to abide by it as it stood.

The President took neither of these courses. In 1941, when the railway unions did not like the recommendations of a Presidential board and threatened to strike against them, the President surrendered to their demands by referring the question back to the board to bring in a set of recommendations that the unions would like better. This was a surrender to a strike threat, a reward for a strike threat, and a blow at the Railway Labor Act. It meant that the elaborate conciliation machinery set up in the act was of little use except to make decisions in the unions' favor. Congress accepted this blow at the Railway Labor Act without passing any resolution.

In May of this year an Emergency Board appointed from the National Railway Labor Panel recommended a general wage increase of 8 cents an hour for the non-operating railroad employees. The President expressed the hope that this award would be acceptable to the unions. The unions were, in fact, prepared to accept it. But just as the award was to go into effect it was vetoed by Mr. Vinson, the President's Economic Stabilization Director. The unions charged that "this action destroyed the Railway Labor Act." Mr. Vinson ordered the Emergency Board to reconsider its decision. The chairman of the Board retorted that Mr. Vinson had no authority to give such an order.

On October 16 the President set up a new Emergency Board to pass upon the wage demands of the non-operating employees. The non-operating unions contended that the President and Mr. Vinson had illegally ignored the Railway Labor Act. They announced the issuance of strike ballots to their 1,100,000 members. Early in November the special Shaw board appointed by the President recommended wage increases from 4 to 10 cents an hour for the non-operating railway employees. The union spokesmen promptly rejected them. In mid-December the Senate intervened by adopting, by a vote of 74 to 4, the 8-cent-an-hour increase originally recommended by the Sharfman emergency board in May.

When both the operating and non-operating unions announced that they had voted to strike, the President ignored all the decisions of his own boards and of his own Stabilization Director and offered to arbitrate personally the questions in dispute. In doing this he still further undermined the standing of his own boards; he offered to substitute an improvised overnight decision for decisions arrived at after long consideration and study, and in effect

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he offered to reward the strike threats by granting more to the unions than they had stood to get before they threatened to strike. He also injected into the dispute considerations of overtime and away-from-home expenses not in the original railway union demands.

Here again he ignored the provisions of the Railway Labor Act which require proper notice to be served by the employees if they wish to make any demands. The solution offered by the President in the case of the non-operating employees was to add something for overtime to the 4 to 10 cent sliding scale increase originally offered by the Shaw board. One of the ironies of the present situation is that, though the Shaw board may bring in a total award higher than the flat 8 cents an hour that the non-operating unions were willing to accept until a few weeks ago, it has become doubtful whether they will now accept even this probably larger award.

In his new executive order the President stated that he was selecting the names of the members for the new board from the National Railway Labor Panel. By doing this, the President again ignores the established machinery for handling these disputes. Under his own executive orders 9172 and 9299, the emergency boards were to be selected by Dr. W. M. Leiserson, chairman of the Railway Labor Panel, who is also chairman of the National Mediation Board.

Thus the President, though he has never asked Congress to suspend the Railway Labor Act, has himself ignored the provisions of that act. He has failed to stand firmly behind the decisions of his own boards or his own Economic Stabilization Director. He has ignored even his own executive orders. Altogether, this is a perfect record of how not to handle a labor dispute.

•

British Workers Debate Post-War Problems

AMABEL WILLIAMS-ELLIS, British Author and Journalist

One of the most interesting things about public opinion in Britain in this fifth year of the war, is the desire felt by tens of thousands of people to study and discuss current and post-war problems, and the fostering of this desire by the authorities. Formal as well as informal discussions go on in the Army, in Civil Defense, in thousands of village halls, and there is a boom in adult education.

But, although a great deal of information on current topics comes to the millions of war workers in the factories—chiefly through speakers, movies, and exhibitions sent round by the Ministry of Information and the Supply Ministries—there has, so far, been little chance in the factories for those who listen or look to take their part in this wave of debate and discussion.

Indeed, with long hours on production, with factory-dispersal and the transport difficulties involved, to say nothing of the fatigue of the workers themselves, the difficulties are formidable.

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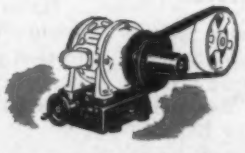

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Installed to protect one or many manufacturing operations, a Cardox System can provide means of detecting fires in such places as areas where flammable liquids are processed, used or handled . . . around electrical equipment or at any of a wide variety of key hazards where one fire could stop all production.

HOW CARDOX SYSTEMS PERFORM

Fire in any of these hazards is detected visually or automatically.

An alarm sounds, giving personal notice to leave the fire zone. Time is allowed for complete evacuation of personnel.

A timed mass discharge of non-damaging, non-contaminating cold Cardox CO_2, released into the fire zone, reduces oxygen content of the atmosphere below combustion requirements and cools out the entire fire. Cardox CO_2—in pounds or tons, as required—is discharged into the fire so rapidly that burning time is cut to a very few seconds.

Extinguishment of this kind is possible with a Cardox System through engineered application of carbon dioxide maintained at a standard storage temperature of 0° F. The advantage of uniform extinguishing performance can thus be provided indoors or out . . . for large or small fires . . . for one or a number of hazards.

If you would like more information for use in solving current war plant fire protection problems—or for consideration in connection with post-war planning—write for Bulletin 1124.

★ ★ ★

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help in overcoming these difficulties, opportunities for discussion might be as welcome to staff, management, and workers in factories as they had proved elsewhere, came from the personnel officer of a group of dispersed aircraft factories. So, with the help of a small grant from an Educational Trust, three of us tried the idea out as a sample experiment in a certain provincial city which was, we hoped, typical. Plenty of objections soon cropped up.

Some managements were suspicious; so were some workers. "Won't it become political?" We said we thought not, as long as politics were not forbidden—if they were, then of course it would. "Where could a factory discussion group meet, and when?" "Would anyone want to discuss current topics?" "How could you get them started?" These were among the many questions to which we had to try to find answers.

The factories of the original group now answer these questions for themselves, and in a most satisfactory way. The discussions have not become political debates. The discussion clubs have usually chosen such topics as housing and town planning (a vital topic because this city has been heavily bombed), education, post-war public health, and foreign affairs.

One group discussed Anglo-American relations, and, after reading up on the United States and hearing two English travelers, got along some American soldiers to discuss it with them, at the end passing a resolution to the effect that factors leading to misunderstanding were of a trivial kind, and that the interests of ordinary citizens of both countries were the same.

When and Where They Meet

As to when to meet and where, most factories use the dinner hour or night-shift break, and clubs meet in all sorts of places, from air-raid shelters and home guard shooting ranges to the firm's boardroom. The clubs recruit their members by simple accretion, generally starting off with a short program of movies shown to the whole factory canteen. These movies are chosen from the Ministry of Information's film list as suggesting (a) the sort of topic that lends itself to interesting discussion and (b) subjects on which clubs can fairly easily get further material.

The suspicion that we might be "Ministries" or in some way official has been completely allayed by the setting up of an obviously democratic and self-governing but informal machinery. The clubs elect their own discussion leaders, choose their own topics, and have now set up a district "inter-factory" committee on which both management and workers are represented.

Another objection — that discussion which fails to lead to something is useless —has been more than amply met by the interest outside bodies soon began to show in these factory activities. First a group of architects, then some doctors, then the staff of a local technical college, then some illustrious bodies indeed (connected with science and with foreign relations), saw in the discussion groups an unusual and valuable way of gaging public opinion on their special subjects.

At first we wondered if the clubs would be willing to choose and to discuss a topic

119 DAYS
from Cotton Field to Airplanes!

Where Texas cotton grew three years ago, deadly war planes stream forth today from a mammoth 70-acre plant, the first unit of which was designed, speeded to completion, and in production in 119 working days—a record as yet unequaled in airplane plant construction.

This plant, and a 40-acre unit at Kansas City — also completed in record time, were built for North American Aviation, Inc., designers and builders of the world famous B-25 Mitchell bomber, P-51 Mustang fighter and the A-36 Mustang fighter-bomber.

Both plants are without windows — blacked out permanently so more than 30,000 workers can continue at top speed night and day under high level fluorescent lighting. Automatically-controlled temperatures and ventilation help maintain high efficiency the year around.

These huge North American Aviation plants are another example of Turnbull engineering skill and construction "know-how" that assure maximum production in the shortest possible construction time. Whether you plan on new, modernization or conversion projects, a discussion of Turnbull engineering advantages will be of vital interest to you.

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America's production soldiers *use their heads* for Victory . . . and M. S. A. Skullgards protect heads in every industry where hazards of falling or flying objects exist . . . wherever the dangers of bumps or blows are present on the job.

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at the request of an outside body. But, as soon as they had their own self-governing arrangements established and felt secure, the clubs were unanimous in wanting to do just this. Here is a new way, they now feel, far better than the usual random sampling of getting the ordinary citizen's point of view made clear to people whose professional opinion carries weight.

At first some bodies with a fine record in adult education were inclined to feel that such discussions must necessarily be superficial. But the elected discussion leaders soon began to demand just the sort of special training that the adult education bodies were able and willing to provide.

The war workers who have experimented are firmly convinced of the value of what they have done, declaring that they find that such activities, among other things, offset war weariness and improve the relations between people with different jobs and functions in the factory.

As outside organizer, I have been chiefly struck with the seriousness without solemnity shown in the discussions, by the willingness of hard-worked people (both workers and management) to give precious free time to such activities, by the skill shown by the factory clubs in devising this informal federation, and in meeting the time, place, and fatigue difficulties, and the deep satisfaction that has seemed to follow this effort in cooperative thinking.

Other districts are now following the example of the original group, in each case with local variations that will make for an interesting diversity when districts as well as factories federate, as they intend to.

•

Prepare Now for Labor's Post-War Demands

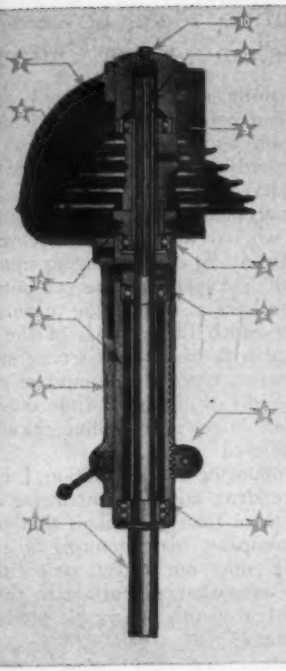
Labor, both organized and unorganized, is growing increasingly more coherent regarding demands for post-war security of job and income, according to the Labor Relations Institute. This trend has immediate significance to employers, who should prepare themselves now for consideration of such matters in any of the following guises:

The Guaranteed Wage—Among the variations of this increasingly popular arrangement will be found (a) the 2080-hour clause, which provides for guaranteed employment for that many hours per year; (b) the partial guarantee, which permits seasonal fluctuations, or for assurances to only a certain part of the staff; (c) the volume of business clause, in which the percentage of employees guaranteed steady employment increases in proportion to the growth of business volume; (d) the annual bonus plan; (e) the 52-pay-checks-a-year plan, providing some compensation every week, whether or not it has been earned.

The Two-Year Contract—More and more unions, according to the Institute, are pressing for two-year agreements, with the goal of sustaining wages and union strength at present levels, despite reconversion letdowns.

Severance Pay—The problem of "mustering out" pay for war workers is under serious consideration by government agen-

Why Industry Prefers THE WALKER-TURNER 20" DRILL PRESS!



1. Double row ball bearing — for thrust and radial load.
2. Ball bearing near spindle center aids rigidity.
3. Ball bearings above and below pulley eliminates whip.
4. Ten spline spindle improves accuracy.
5. Aluminum alloy spindle pulley permits speeds above 5000 r.p.m.
6. One piece head casting, bored in line.
7. Pulleys and belt amply guarded, yet easily available.
8. Steel quill turned from bar, seats bored and rack milled in quill.
9. One piece feed pinion and shaft, with teeth cut on gear hobber.
10. One-shot lubrication — oil applied at one point only.
11. No. 2 Morse Taper Spindle Nose.
12. Power feed take-off pulley. Feed coordinated with spindle speed.

The sectional view above illustrates the careful design that provides an unusually smooth-running spindle in Walker-Turner 20" Drill Presses. These rugged production machine tools are in use in great numbers in war industries today. Due to their versatility, many have been applied in special tooling set-ups of various kinds. Simplicity of controls permits their use by unskilled and semi-skilled labor — an important point under present conditions as well as in the post-war period.

Send for descriptive literature

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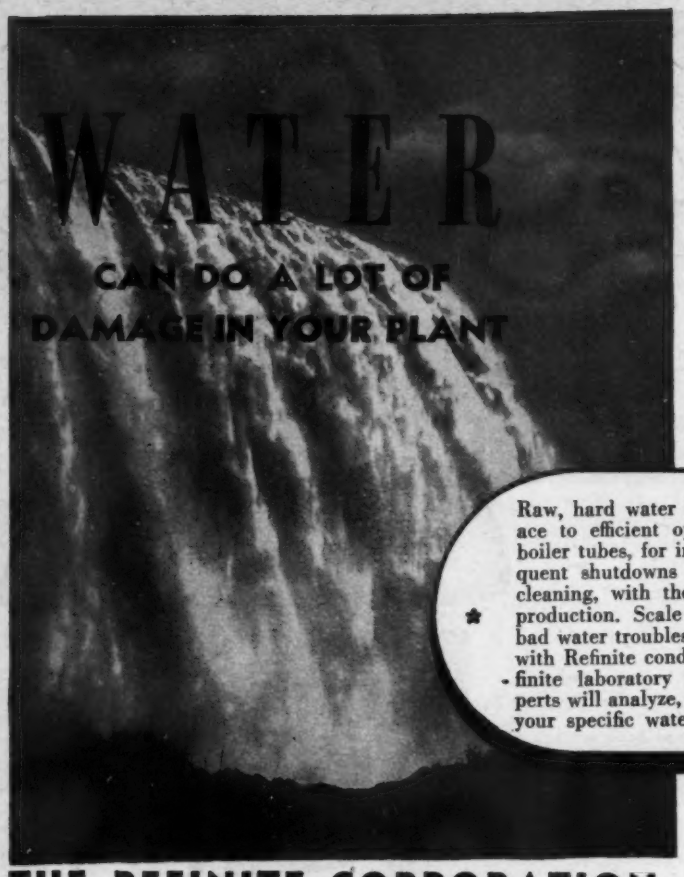

Raw, hard water is a constant menace to efficient operation. Scale in boiler tubes, for instance, causes frequent shutdowns for turbining and cleaning, with the resultant loss in production. Scale and the many other bad water troubles can be eliminated with Refinite conditioned water. Refinite laboratory and technical experts will analyze, without obligation, your specific water problem.

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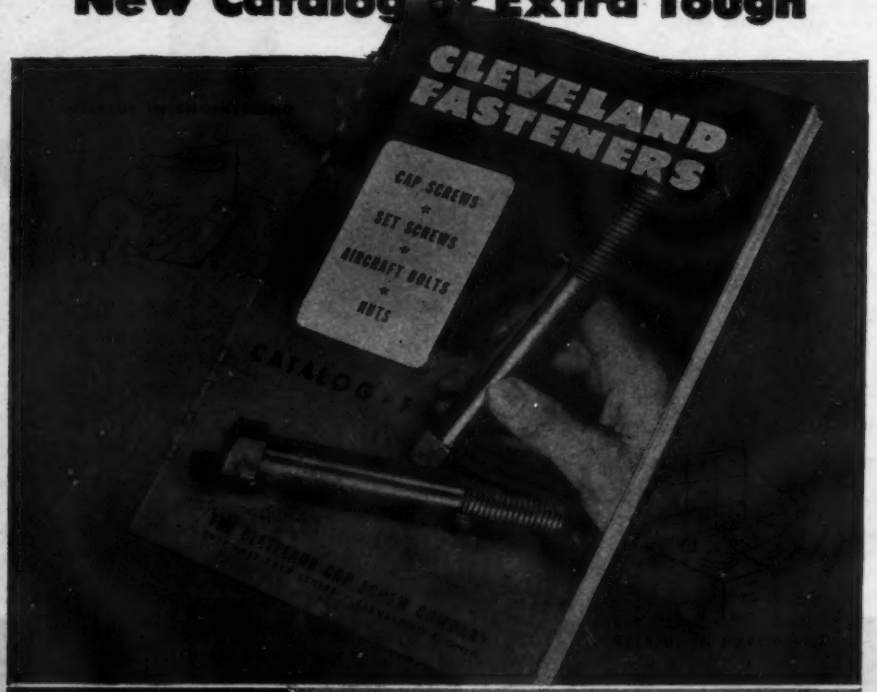

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cies, and it appears inevitable that some scheme will emerge—probably in the form of compelling industry to set aside "rehabilitation" funds for employees who are laid off. Members of the Institute have been warned to hold off on severance pay, pending clarification in Washington, unless they already have established plans which were in force prior to passage of the Wage and Salary Stabilization Act. The reason behind this caution is the fact that the granting of severance pay by companies which cannot point to past policy may be interpreted as a "hidden" increase, and therefore construed as a violation of the Wage Stabilization Act.

•

Incentive Plan Lowers Prices, Increases Output

That an incentives plan, properly administered and correctly figured, can increase production and decrease costs was once more proved by the Lincoln Electric Company, Cleveland, last year. At the year's end about $3,000,000 was distributed to factory workers and offices employees of this company, in checks ranging from $25 to $50,000. Payments were computed on the same basis as that of the previous ten years, in which the earnings of the man, combined with his years of service and his development, gaged the amount of money he received. At the same time enormous reductions in costs and selling prices have been achieved.

In announcing the distribution, J. F. Lincoln, president, said: "By producing at the rate of more than four times that of any other company manufacturing a similar type of product, our workers are entitled to rewards somewhat proportionate to their participation in this remarkable production achievement."

•

How Electronics Is Aiding War Production

The familiar field of radio communication and the restricted fields in which new and secret devices are employed are by no means the only ones in which electronic equipment and electron tubes are helping to win the global war, according to Edward C. Cahill, manager of the industrial and sound department, Radio Corporation of America.

In addition, electronic equipment has contributed importantly to the successes of United Nations forces during 1943 by making possible an acceleration and refinemen of industrial processes to speed and improve war production. It has also been a potent force for strengthening of morale in war plants and on the fighting fronts, and has facilitated swift, thorough training of military, naval, and industrial personnel.

Electronics in Industry

Among the newest of the many applications of electronics are those now being used to perform industrial tasks.

These applications are making possible

Mastery Over Materials

More important even than the nature of the materials that go into your Dayton V-Belts is Dayton Rubber's mastery over those materials—the proved ability to make them serve you better. That is why, whether manufactured from natural or synthetic rubber and fabrics, every Dayton V-Belt can handle the job for which it is intended.

Woven into every one of these V-Belts is the knowledge and experience of 37 years of progressive achievement—the technical zeal which in just one year called for 166,000 man-hours of research and experiment on V-Belts alone—the practical follow-through which required 1,000 laboratory tests and 1,200 field tests in the same period.

You can always be sure that the Dayton Rubber name on any V-Belt is a guarantee of service above and beyond that dictated by ordinary standards.

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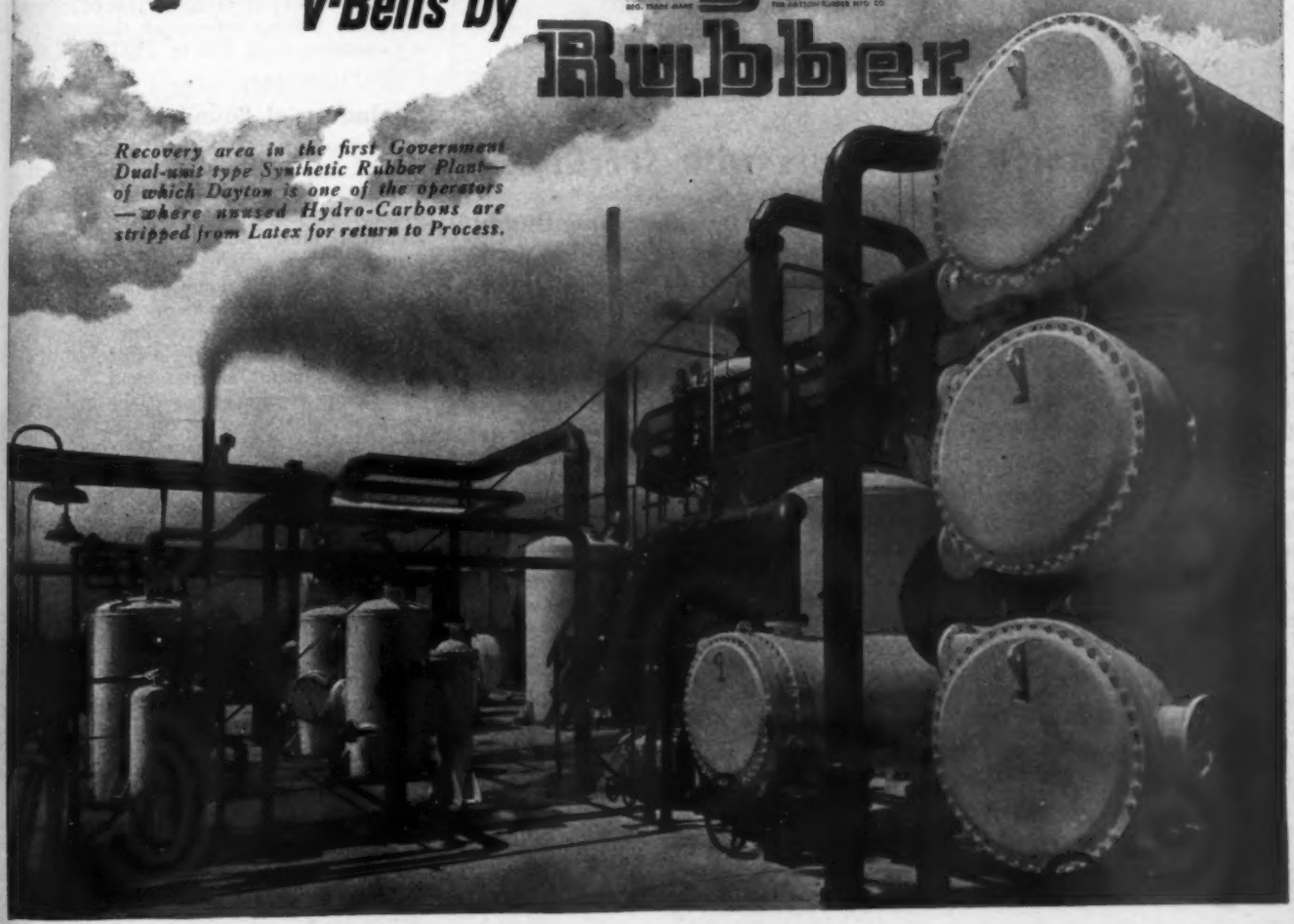

Recovery area in the first Government Dual-unit type Synthetic Rubber Plant—of which Dayton is one of the operators—where unused Hydro-Carbons are stripped from Latex for return to Process.

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There's one (or more) in every Plant. Rules or no rules, some Dumb Doras *will* sneak smokes and drop matches or butts on oil-soaked waste, rags and other inflammable absorbents. You can foil these "unconscious saboteurs" by spreading SPEEDI-DRI, the famous oil- and grease-absorbent on *all* oily floors. It works fast. It's economical. It retards fire, even when oil soaked (just ask your insurance company about that!). What's more, it sets up an immediate non-skid surface preventing many a falling and slipping accident —a major cause of industrial casualties. SPEEDI-DRI will brighten your plant, improve morale, speed production, and save vital manpower by freeing porter labor for more important jobs. Write for literature and FREE SAMPLE.

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increased accuracy, thoroughness, efficiency, and speed in such processes as molding and bonding of plastics and wood products; case-hardening, welding, soldering, annealing, and tempering of metals; seaming of fabrics; baking of paint finishes; and drying of textiles. Similar advantages are offered by electronic devices designed for measuring, counting, detecting, timing, and operating automatic machinery, and protecting workers from injury.

Leading this field, in point of industrial utilization is radio-frequency heating whose advantages stem from the fact that heat is generated within the material instead of being applied from the outside. In the heat-treatment of metals and other conducting materials, currents are induced in a selected surface area of the piece being treated, and both the area and the depth of penetration can be closely controlled. In the heating of so-called non-conducting materials, such as wood and plastics, the piece is placed in the path of radio-frequency currents flowing between two electrodes. These currents generate heat uniformly throughout the piece, whereas external sources of heat tend to overheat the surface of the piece before the inside is thoroughly heated.

Electronic devices have also proved particularly adaptable for continuous processes. Use of a revolving table for passing setscrews through an induction coil, for example, has made it possible to harden the slotted ends of the screws at the rate of 2700 an hour. Another example is a conveyor belt for carrying radio condenser cans through the induction coil for a soldering device. The introduction of radio-frequency heating stepped up this soldering operation from 100 to 2500 units an hour.

Industrial Sound Systems

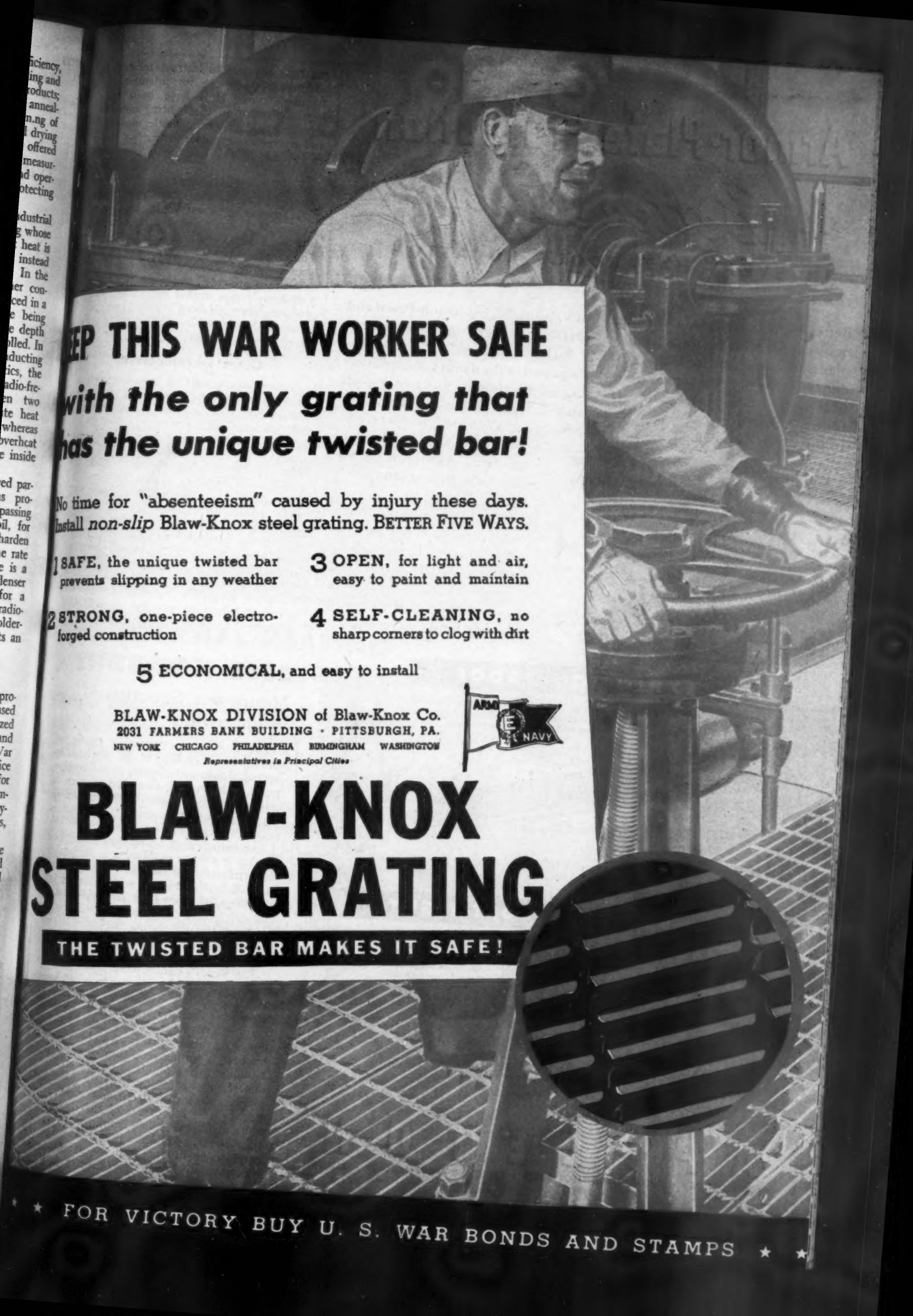
Time savings in training as well as production, improved morale, and increased administrative efficiency have been realized through the use of plant broadcasting and industrial music service systems. War plants use these systems also for interoffice and intershop communications, and for broadcasting executive messages and company announcements, recordings of daytime rallies for the benefit of other shifts, and "home talent" entertainment.

Wartime experience has established the practical value of such equipment, and there is every reason to expect continued and increasing use of these systems after the war, says Cahill.

Film Sound Equipment

An impression of the scope of the work which film sound equipment is doing may be gained from reports recently published in film trade papers. In the field of training films, for example, it was stated that copies of nearly 2000 such films from the various military forces of the United Nations have been assembled in Washington, D. C., by the United Nations Central Training Film Committee. A large number of industrial training films have been turned out since the start of the war by the U. S. Office of Education, and more are in production.

Observers estimate that the use of military training films has cut by 40 percent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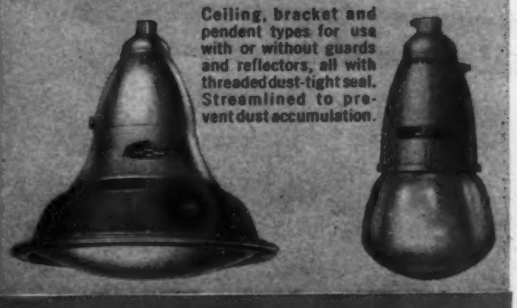

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the time required to instruct recruits. In addition to their use for intensive basic training, sound films have been found highly effective on the fighting fronts for recording and reviewing battle maneuvers and as a means of quickly instructing troops in the use of the new items of combat equipment.

In the entertainment-for-morale program, it was reported, the latest Hollywood movies are now being seen by an average of 630,000 overseas men in uniform each night in all theaters of the war. The figure was based on data obtained from a survey of attendance at 1269 motion picture shows presented the night of October 1 at Army camps around the world. These attendances ranged from 15,000 in an open-air amphitheater in New Guinea to 11 men in an Alaskan outpost.

Other Developments

Among the results of new engineering development in the film sound field are the mobile recording unit—a completely self-contained, self-powered "studio on wheels," mounted on a truck chassis designed for tough locations—and the 16-mm. projector.

Shock-mounted on rubber and steel in a tough plywood case, the projector not only withstands an 18-in. drop onto a concrete floor, but also functions properly after being dropped from a 3-ft. table. The unit is engineered to function smoothly under extremes of temperature, humidity, dust, and other factors of environment. An other advance is the incorporation of a rotary stabilizer to provide smooth film movement required for high fidelity reproduction of sound.

•

Manpower Situation Is Improving

The manpower situation is easing, according to the findings of the National Industrial Conference Board. Total employment, including all men and women in military service, declined in November for the second successive month, with further reductions indicated for December.

The reduction of 1.2 million in the total number at work or in uniform in November was attributable in the main to the curtailment of farm operations at the close of fall harvesting, the report states, but civilian non-agricultural employment also receded by about 100,000 during the month, and was below the corresponding total for November, 1942, by almost the same amount.

The Board's employment total for November fell to 63.1 million, which compares with the all-time high of 64.4 million in September and 64.3 million in October. Farm employment dropped to 10.1 million from the seasonal peak of 11.7 in September. A further reduction of more than a million in the number at work on farms in December is suggested by the usual seasonal employment pattern, according to the Board. The full extent of the decline in non-agricultural civilian employment is partially concealed by the rise in November of employment in retail trade, most of which was temporary or on a part-time basis. The

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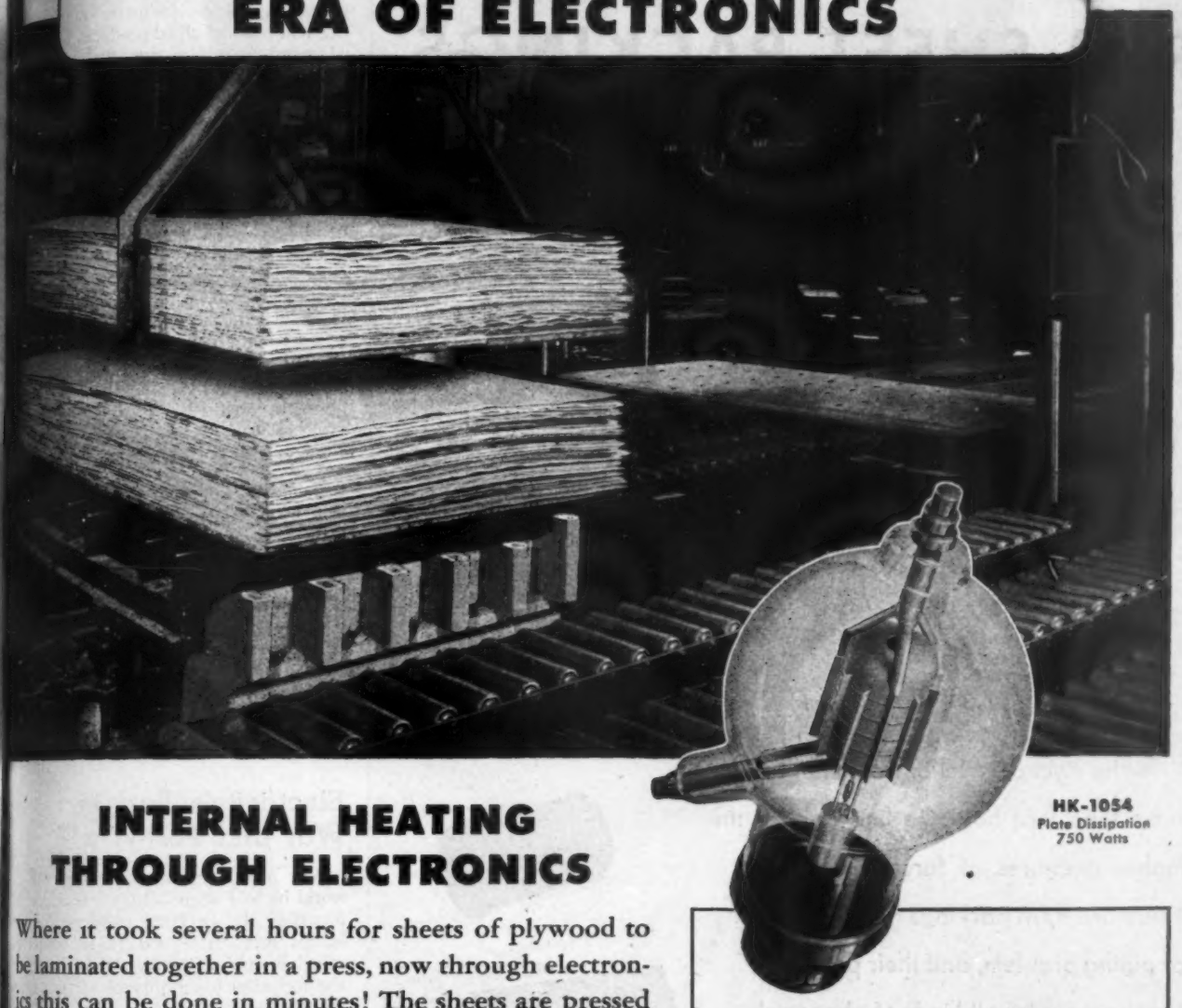

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INTERNAL HEATING THROUGH ELECTRONICS

Where it took several hours for sheets of plywood to be laminated together in a press, now through electronics this can be done in minutes! The sheets are pressed between two huge electrodes through which alternating current flows at more than a million cycles. This radio-frequency current disturbs the molecular structure of the plywood thus generating internal heat which accelerates the bonding process.

After the war Gammatron tubes will be made available for use in marvelous electronic devices such as this. Heintz and Kaufman engineers will then help pioneer many industrial applications of electronic tubes for greater production, safety, and efficiency.

The vacuum tube is an electronic valve

In a two-element vacuum tube, current flows from the hot *negative cathode* to the *positive plate*. Within limits, an increase in plate voltage will result in an increase in electron flow, or plate current.

If a third element consisting of a fine mesh screen, or *grid*, is inserted between the cathode and plate, it likewise can control the number of electrons reaching the plate.

When the grid is made sufficiently negative it will reduce—or even prevent entirely—the passage of electrons to the plate. (Because electrons are negative charges, and like charges repel each other.) Inversely, if the grid is made positive, it will speed the flow of electrons. The grid is placed close to the cathode, and consequently is the major factor in controlling plate current.

Thus the grid acts as a valve, and large amounts of power in the plate circuit may be controlled by an infinitesimal amount of power in the grid circuit.

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JOIN UP *with* R/M SHEET PACKINGS

The right connections are vital today —the kind that hold the line against the higher pressures of forced production. There are R/M packings for every type of piping problem, and their performance under all kinds of abnormal, war-time conditions is high tribute to the years of research and development. If you find it difficult to obtain R/M packings for the present, please remember high priorities must be served.

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Makers of Packings for Every Industrial Use

only other substantial offset to the downward trend developed in durable-goods manufacturing, particularly in the war-converted automotive industry. Employment in chemicals and allied products, which had advanced sharply in previous months, fell off as a result of initial curtailment and plant shutdowns accompanying the cancellation or downward revision of small-arms contracts .

"The number of key industrial areas in which a slight labor surplus will exist," the report concludes, "has increased from 102 to 112, according to War Manpower Commission field reports. The total of acute labor shortage areas declined from 69 in December to 67 a month later, while the roster of probable labor shortage areas receded from 124 to 119 in the same time interval. After allowance for revised production schedules, official forecasts of probable labor requirements through July 1, 1944, were again lowered by 600,000. The number in the armed forces at the end of 1943 was lower than previous forecasts of 10.7 million. This figure will not actually be reached until well toward the close of the first quarter of 1944. Against this background of easing labor requirements, except for manpower for military services, the proposed enactment of national service legislation would appear to be designed to assure the full time performance of those at work rather than to introduce a large body of new workers."

•

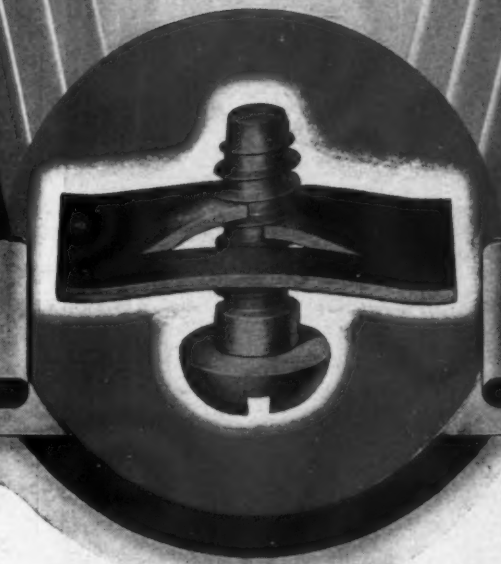
Electricity's Part in War and Post-War

Not until the war has ended will the world be told about all the recent developments in the electrical industry, and how it has met faster and faster production schedules and at the same time maintained the technical superiority of our war equipment. Research workers and design engineers have been called upon to produce new materials, with better qualities, to replace those made scarce or unavailable because of the war; to invent new methods of defense; and to create entirely new weapons. Engineering and manufacturing personnel have been called upon to produce more from less, quickly, to reduce costs, to maintain or better production schedules, to save critical materials, to improve designs, and at the same time to conduct programs to train thousands of new workers.

All these facts were brought out recently by R. C. Muir, vice-president, General Electric Company, in a foreword to that company's annual review of electrical developments. "In any review of the electrical advances," Muir says, "the applications of electronic equipment are conspicuous... Years ago the phrase 'Electrons in Overalls' was applied to industrial applications of photo-tubes, thyratrons, and other electronic tubes; today electrons are not only in overalls, but in uniform, too. Communications is only one of the important fields in which electronic tubes are now serving...

"Just as industrial electronics has stepped to the fore, so the amplidyne, already performance-proved in dozens of industrial ap-

Fastest Thing in Fastenings



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RESIST VIBRATION LOOSENING

Speed Nuts

Conserve Manpower • Reduce Assembly Costs

The SPEED NUT SYSTEM embraces over 2000 fastenings in various shapes and sizes. Every SPEED NUT and SPEED CLIP was developed to do a better fastening job and to do it faster. All are lighter in weight... conserving metal, man-power and assembly costs. More important still, the SPEED NUT, engineered to accomplish a double spring-tension lock, resists vibration loosening as no other fastening. The six SPEED NUTS illustrated are merely typical of the wide range of shapes used in the assembly of metal, plastics, and wood. If you have not yet adopted the SPEED NUT SYSTEM of assembly wherever possible, a surprise is in store for you.

Write for summary catalog 185.

TINNERMAN PRODUCTS, INC.

2096 FULTON ROAD CLEVELAND, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In England: Simmonds Aerocessories, Ltd., London

INSULUX IS

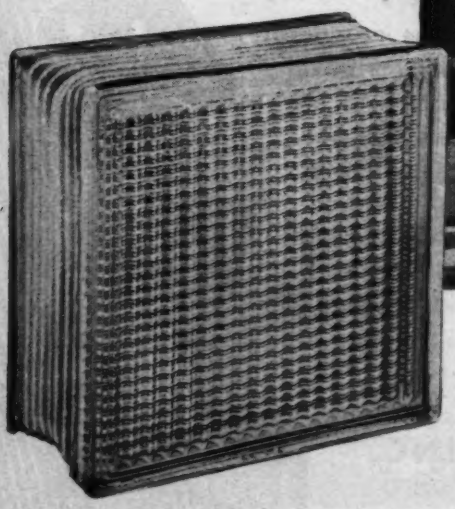
FACTS YOU SHOULD KNOW ABOUT INSULUX GLASS BLOCK

DIMENSIONS: Made in three sizes, 6, 8, and 12 inches. All are 3⅞ inches thick, with ¼ inch sidewalls. INSULUX Glass Block are hollow, hermetically sealed, with a partial vacuum.

STYLES: INSULUX is made in a variety of patterns for functional and decorative purposes. Some permit limited visibility; others insure complete privacy. INSULUX diffuses, distributes, and directs daylight in predetermined quantities—depending on the design selected.

HOW TO INSTALL: INSULUX Glass Block are laid up much like brickwork—with a mortar bond. Any competent mason can install INSULUX panels. Little or no critical material is used.

WHERE TO BUY: INSULUX distributors are located in all cities. You can buy INSULUX in any quantity from a case of 12 block to a carload. INSULUX is available immediately without priority—at economical prewar prices.



OWENS-ILLINOIS

INSULUX

GLASS BLOCK

plications, has been battle-tested in aircraft turrets and many other military applications. . . . Although it is a development of recent years—and hence perhaps to be thought of as only beginning to find its field of applications—the amplidyne has improved many existing electric applications and made others practical for the first time.

"While emphasis during the year was on production devoted directly to war equipment, the electrical manufacturing industry was also, of course, called upon for new designs of apparatus for war production by other industries—turbines, generators, transformers, switchgear, and other apparatus for generating and distributing needed power; motors, controls, electric furnaces, welding equipments, and other apparatus for use in industry; electric equipment to solve transportation problems on railways and highways, on the sea, and in the air; X-ray and other testing and measuring equipments for the control of manufacturing processes and the inspection and calibration of the finished products; improved illumination for factories and offices; and equipment for air conditioning and refrigeration. Research workers were called upon for the solution of numerous and important problems. Their accomplishments are to some extent reflected in the year's progress report, but still others are yet to become apparent in the improved products of the future."

•

An Encouraging Picture of Post-War Employment

That a deep concern exists over the employment situation immediately following the end of the war is indicated by many statements, of which the one by Stuart Chase in the May, 1943, issue of the *Survey Graphic* is typical: "Thirty million Americans in the armed services or munitions industries (will have) to be transferred from the occupations of war to those of peace. Some very careful planning is in order if 30 million citizens are to be transferred from war to peace without disaster."

In a study, "Post-War Reemployment—The Magnitude of the Problem," published by The Brookings Institution, Karl T. Schlotterbeck delves deeply into the problem, and comes up with the following conclusions:

"1. Demobilization will be gradual rather than precipitate in character. It will extend over a period of two to three years—depending upon the time required to liquidate the Japs after the Nazis are defeated. Industrial reconversion and reemployment are even now under way, and the process will be rapidly accelerated after the termination of the European conflict, and from 6 to 7 million war workers and service men may well be demobilized before the end of the Asiatic conflict.

"2. During the transition years the employment problem will be eased somewhat by the fact that the total number of potential workers will be appreciably smaller than in 1940. This results from the fact that substantial numbers will still be in

YOUR ANSWER

TO WINDOW REPLACEMENT PROBLEMS

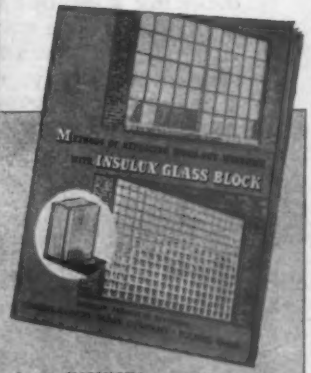
INSTEAD of putting up with worn-out windows these days, many factories are making sure of efficient and economical production on war orders by remodeling with INSULUX Glass Block.

Glass Block are immediately available and easy to install.

INSULUX *Light Directional* Block bring controlled daylighting to industrial plants. Prismatic designs direct light to ceilings, distribute it evenly throughout interiors.

INSULUX saves on heating costs by reducing heat loss of large light-transmitting areas. A panel of four-inch-thick hollow glass block has the same insulating value as an eight-inch brick wall.

Other advantages of INSULUX panels include lowered maintenance—because INSULUX is highly resistant to damage, is easily wiped clean, never needs painting. Solid construction bars dust, dirt, and moisture infiltration. INSULUX is fireproof—noncombustible.



Our 24-page section in Sweet's Catalog contains complete illustrated and statistical information about INSULUX. If not available, write INSULUX Products Division, Owens-Illinois Glass Company, Dept. 114, Toledo, O.

OWENS-ILLINOIS
INSULUX
GLASS BLOCK

IT'S NOT YOUR GLASSES, MISTER

BANISH ANNOYING BLINK WITH THE G-E *Watch Dog*

For 100-watt Lamps

For 40-watt Lamps

Blinking and flickering of dead fluorescent lamps can become a great source of irritation to busy war workers. Such undesirable lighting conditions retard production, result in poor workmanship and increase spoilage. To banish annoying blink immediately and positively, General Electric offers its popular line of G-E Watch Dog Fluorescent Starters.

When a lamp reaches the end of its useful life, blinking and flickering start but the Watch Dog stops 'em cold! This manual reset starter cuts itself out of the circuit by eliminating all flow of current. And that's not all—dead lamps are prevented from being started needlessly, current is saved, ballast is safeguarded and starter life is prolonged. In short, maintenance time is substantially decreased.

Do you want to know how to use fluorescent accessories for best lighting results? Write for the new G-E Fluorescent Accessories Catalog. Send your request to Section G-243-37, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

the armed forces, while at the same time there will be a bulge in the number in schools and colleges.

"3. In a dynamic society 'full employment' does not imply complete employment of the labor force; several millions would, for one reason or another, not be working at any given moment. A state of reasonably full employment at the end of the transition period would be realized with an employment level of 54 millions. This would mean an increase in employment over 1940 of about 8,000,000, or roughly 17 percent.

"4. The additional employment required will have to be found not in manufacturing alone but in all the major fields of economic activity—including transportation, public utilities, mining, agriculture, construction, trade, and service activities. Since there is good reason for believing that the level of production and employment will for some years be substantially above that of 1940, the outlook for satisfactory employment is distinctly encouraging."

•

Defining Union Security

There are several degrees and types of union security. In "Maintenance of Union Membership," published by Industrial Relations Counselors, the term is used to include the following conditions that have been demanded by the unions in cases before both the Defense Mediation Board and the War Labor Board (the definitions were taken from U. S. Bureau of Labor Statistics, "Report on the Work of the National Defense Mediation Board, March 19, 1941, to January 12, 1942"):

"1. The closed shop, in which all persons employed must be union members when hired and must remain union members during employment.

"2. The union shop, in which all persons employed must within a specified time after hiring become and remain union members.

"3. Union maintenance, in which all employees who at the time the contract is signed are union members or thereafter become union members must maintain membership as a condition of employment.

"4. The check-off, which requires the employer periodically to deduct a stated portion of an employee's pay and transmit it to the union the amount deducted as dues. The check-off may not require the consent of the union member or it may require specific authorization, and in the latter case it may or may not permit revocation of the authority. The check-off provisions introduced into agreements under the auspices of the National Defense Mediation Board, none of them as a result of recommendation, were of the voluntary type with limited power to revoke.

"5. Preferential hiring, in which union members are given preference in employment.

"6. Employer recognition or encouragement of union membership, which may be

A tip on turbine economy straight from the horse's mouth: "Don't use 'Elephant Power' steam turbines too big for the job when COPPUS 'horsepower' steam turbines can be obtained in 6 sizes from 150 H. P. to fractional. Each smaller frame saves metal for front-line fighters and money for you. And COPPUS Blue Ribbons mean quality you can count on in the home stretch"

COPPUS TURBINES

Save Metal in Wartime — Will Save You Money in Peacetime

Like all Coppus "Blue Ribbon" Products (blowers, ventilators, gas burners, etc.), the Coppus steam turbine is a precision-made product . . . controlled by Johansson size blocks . . . and every turbine is dynamometer-tested before shipment. More than 85% of all orders since 1937 have been repeat orders.

Write for Bulletin 135-9

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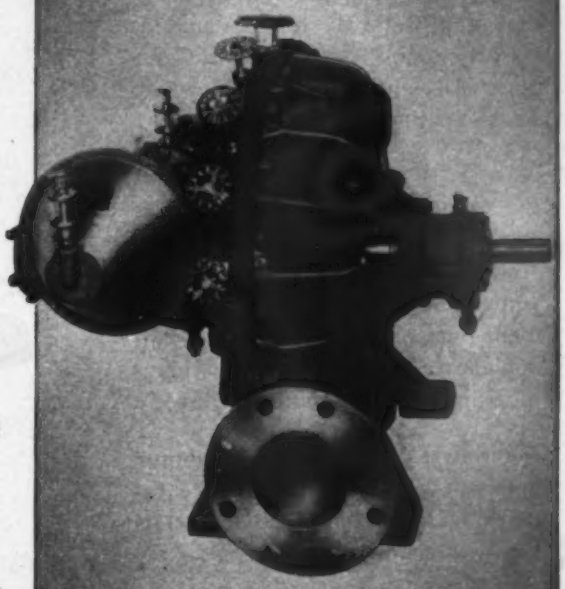
452 Park Ave., Worcester, Mass.

Sales Offices in THOMAS' REGISTER
Other "Blue Ribbon" Products in
REFINERY CATALOG



COPPUS

BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY
ENGINEERED FOR YOU

SIMPLICITY OF DESIGN MEANS EASIER MAINTENANCE . . .

LENDING A HAND *to the* MAINTENANCE MAN

● He can use plenty of help these days . . . his job of keeping the machinery of production going takes all he can give it. And among his most vital needs are valves that won't take a lot of costly time out for repairs . . . valves that he can depend on for uninterrupted performance.

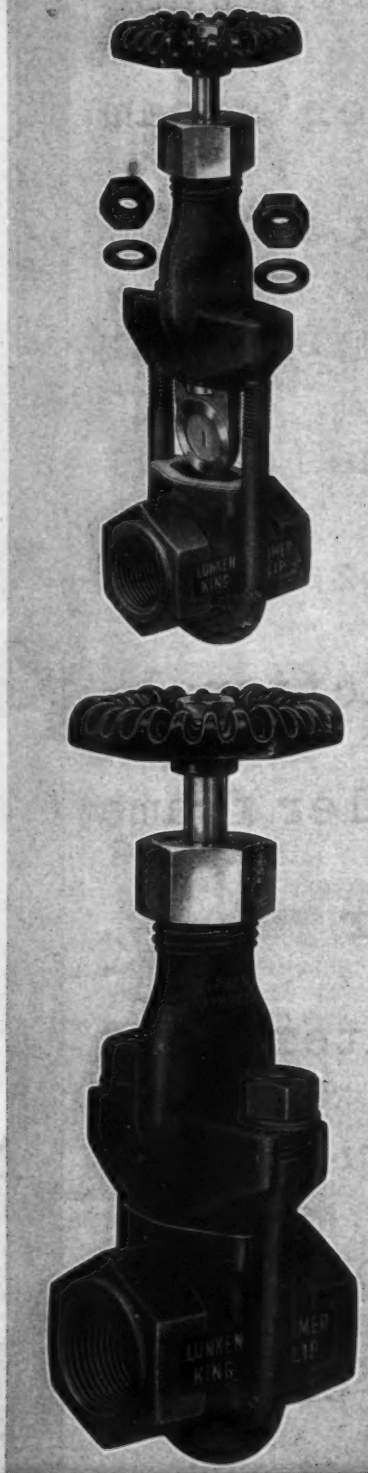
Such a valve is the Lunkenheimer "King-clip". Simple in design, exceptionally sturdy in construction, the "King-clip" is at its best when the going is tough. Also, it's a valve that lends itself to easy maintenance.

Note the illustration. See how easily the "King-clip" can be taken apart . . . how it simplifies maintenance. And when repairs are necessary, you can be certain that any replacement part will fit accurately—Lunkenheimer precision-gauged manufacture gives you that assurance.

Let your Lunkenheimer distributor help you with your maintenance, repair and operating problems. His facilities are at your call.

YOU CAN TAKE IT APART IN A JIFFY . . . . . .

Simply unscrew two nuts at top of clip and entire bonnet-stem-disc assembly can be lifted from the body with complete accessibility for inspection or repairs.



ESTABLISHED 1862
THE LUNKENHEIMER CO.
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LUNKENHEIMER VALVES

confined to statements of good-will or friendship contained in the agreement, or may require the employer to make known his approval of union membership to each new employee. An occasional contract clause gives to the union exclusive privileges to use bulletin boards and other plant facilities.

"7. Discipline of anti-union activity, which requires the employer to discipline by discharge, layoff, or otherwise, persons whose activity imperils the position of the contracting union. Variations are concerned primarily with respect to enforcement procedures and range from an unimplemented promise of the employer to impartial arbitration."

The study itself is based on some 200 union security directives of the National War Labor Board and the experiences of 59 companies in the application of the maintenance-of-membership clause. Among its findings are:

1. The War Labor Board has directed maintenance of membership in about 75 percent of the cases in which it was an issue.

2. The compulsory check-off, in combination with maintenance of membership, has been ordered in 32 percent of the cases, and has been granted more freely since the President's wage stabilization order.

3. The public and labor members of the board were agreed on 97 percent of the decisions granting maintenance of membership.

4. Less than 10 percent of the employees of the reporting companies resigned from their unions during the escape period, and less than 1 percent tried to resign after the clause became effective.

5. The great majority of the reporting employers oppose maintenance of membership and do not feel it has improved their industrial relations.

6. The unions do not regard maintenance of membership as a satisfactory compromise of their demands for the closed or union shop.

●

Few Design Changes for Early Post-War Period

Do not look for American industry to blossom forth immediately after the war with a lot of new models and new products of startling design, warns McKinsey & Company, management consultants, in a report summarizing the findings reached by this firm after a survey of the leading consumer goods industries. Says the report: "American consumers who expect shortly to be able to buy motor cars, refrigerators, and other mechanical items used in the home, quite different in design and performance from the models of 1941, are likely to be disappointed.

"Should they be preparing themselves for such unusual developments as commutation by helicopter, replacement of the lowly freight car by the cargo plane, and substitution of electronics for manual serv-

Giving Strength to a "Bull"... Taking Time from a Clock

That bulldozer . . . butting dirt and rocks with an impact that shakes the teeth of the driver . . . needs plenty of guts in the bolts and nuts that fasten its joints.

That clock . . . racing a production schedule, with costs counting the minutes it takes to assemble it . . . needs bolts and nuts so easy-fastening they nearly *fly* into each other's arms.

For strength that survives the worst licking a tractor or train or trestle can dish out . . . for accurate mating that saves precious assembly time: assemble with RB&W bolts and nuts.

For 99 years . . . RB&W has pioneered in the development of better and stronger fasteners.

From 1850, when it designed and built the world's first cold header, until 1944, when its great batteries of modern equipment still represent the latest achievement in bolt and nut making history . . . there has been no slackening in effort to improve its product.

During the past generation, hundreds of thousands of dollars have been spent by RB&W in experimental and research work on nuts alone.

This is only one reason why so many great names in industry have come to depend upon RB&W for fasteners that make their products stronger, faster, better.

RB&W *Making strong the things that make America strong*

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Factories at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill. *Sales offices at:* Philadelphia, Detroit, Chicago, Chattanooga, Los Angeles, Portland, Seattle

CM HERC-ALLOY SLING CHAINS boast service records as long as your arm

Ask any plant executive or safety engineer who has used CM Herc-Alloy Sling Chains... their experiences will prove the reasons why that once they are put on a job they "stick." In fact, CM Herc-Alloy Sling Chains shipped years ago are still in service.

The patented Inswell electric welded links and all fittings are of Herc-Alloy formula steel with a tensile strength of 125,000 lbs. per square inch... a safety factor of 150% compared to ordinary sling chain. Herc-Alloy seldom, if ever, requires annealing.

There is a size and type to handle *your* job and prove in service that here is sling chain value *plus* by any method of figuring.

Get all the details now from your mill supply distributor or write us.

COLUMBUS-McKINNON
CHAIN CORPORATION
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GENERAL OFFICES AND FACTORIES: 130 Fremont Ave., TONAWANDA, N. Y.
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ices in their households, their disappointment is practically assured."

Findings in the survey point unmistakably to the fact that when normal peacetime operations are started once agan, the output of almost all industral plants will be quite similar in design and performance to the products of pre-Pearl Harbor days.

"The new post-war automobile, for example," the report continues, "may appear at first glance to be a different car from the 1941 models, but it is quite likely that the changes will be result of the elimination or addition of certain unimportant accessories, largely decorative in character, the basic details of power, weight, speed, and gas consumption being essentially the same as in the late pre-war models.

"And the same condition will be true of other household products. It isn't that the engineers and designers have lost their skill, or that management is in slump, but rather that the resources of American industry have been absorbed in the production of armaments to such an extent that there has been neither time nor opportunity to plan for the production of new models for peacetime.

Takes Time to Change

"When management does get the go-ahead for a real change-over to peace, it will show the same resourcefulness and effectiveness it did in providing the weapons for war. But the process of management takes time. It involves making plans, retraining people, and then overcoming their inertia in doing the old things—all of them time-consuming activities."

According to the survey, the best that can be hoped for is that with the advent of peace in Europe, most American manufacturers will be able to take up again at about the point they left off some two years ago. "However, they will not be able to do this immediately, and the time lag is a more serious matter than most Americans realize," the report continues.

"The fact is that when American industry was asked to go into armament production, its speedy compliance brought about a really drastic reorganization of plant facilities. Costly machine tool equipment was uprooted and stored on vacant lots, cement assembly lines were torn up with pneumatic drills and new ones laid, and in many instances even the actual plant walls were torn down and rebuilt to accommodate the new production procedures involved in armament manufacture.

"Few people realize that the production of a motor car and various other mechanical units in popular use involves the services of hundreds, and in some instances, thousands of supplying companies, each producing some material or accessory item which must be brought from distant points in an orderly way to the final place of assembly.

"It required the better part of a year under the urgent pressures of war to convert this complicated industrial organism into an efficient producer of armament. It is extremely doubtful if reconversion can be effected in less time. More likely a considerably greater time spread will be required."

The results of the survey indicate that the plant operations of fully half of the

WHAT DO YOU KNOW ABOUT YOUR COMPETITOR'S COSTS?

You know the market price of metal, and the going wage rates. You can readily figure time schedules and overhead.

You can come pretty close to estimating how much it costs your competitor to make his goods. But after all, *your own costs* are more important to you than his.

You won't need to worry about him at all, once you are sure *your* costs are as low as modern production technique permits, consistent with acceptable quality.

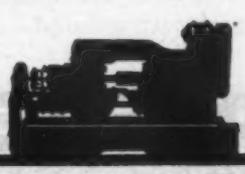
In war production, Acme-Gridley Bar and Chucking Automatics have been turning out parts for guns and ammunition by the million — without fuss or delay, at speeds that set new records.

And these millions of identical parts conform to brand new standards of uniformly accurate dimensions.

When the shooting is over the speed and precision of these same Acme-Gridleys will be ready to make equally important contributions to meeting competition with better products — at lower costs.

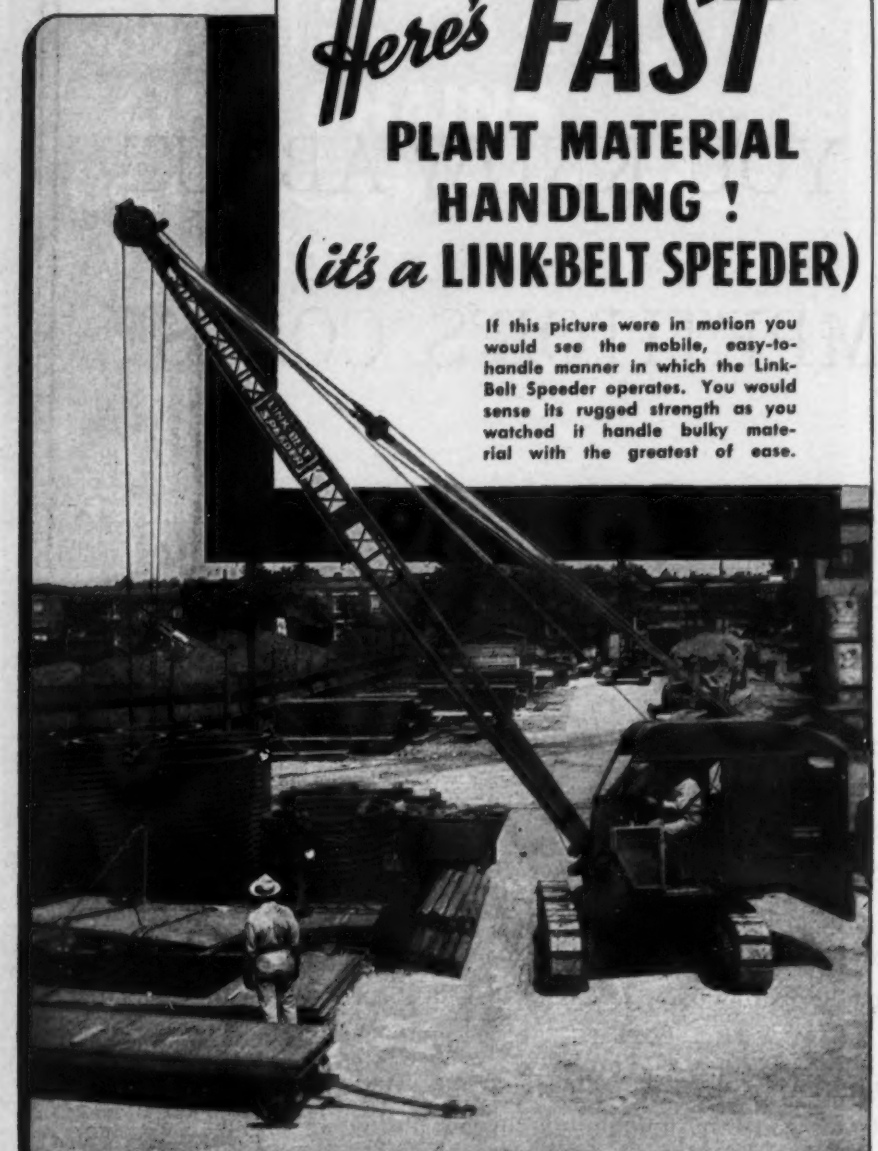
The NATIONAL ACME *Company*

CLEVELAND · OHIO



ACME-GRIDLEY AUTOMATICS
maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

Here's FAST PLANT MATERIAL HANDLING ! (it's a LINK-BELT SPEEDER)



If this picture were in motion you would see the mobile, easy-to-handle manner in which the Link-Belt Speeder operates. You would sense its rugged strength as you watched it handle bulky material with the greatest of ease.

☆ BUY BONDS AND MORE BONDS ☆

The trend in plants throughout the country is to Link-Belt Speeder, as these rugged, material-handling machines point the post-war way to greater efficiency around the plant. Here's a machine that pays for itself many times over in speedier, more efficient service and in saving of man hours!

9429

LINK-BELT SPEEDER

Builders of the Most Complete Line of
SHOVELS-CRANES-DRAGLINES

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO-9, ILL.
A DIVISION OF LINK-BELT COMPANY

country's industrial organizations have been drastically changed as a result of their conversion into armament production.

In addition, however, to the time requirements incident to the conversion of plant facilities, an additional time element is involved in bringing a new model through the several stages of development and field testing that precede its actual presentation to the buying public.

"All in all," the report concludes, "it will be apparent to any competent observer who will take the time to study the conditions now prevailing in the fields of production and distribution that the bright new world, so generously outlined as an immediate after-war development by some of our best writers, has been compounded in large measures of dream stuff. Ultimately, many of its details will be realized, of course, but the architects of the new order will be hard-headed management, employing proved procedures, carefully spaced and applied over a period of some four or five years at a minimum. These realists make few promises, and so far have refrained from encouraging the consumer that the time lag indicated by the survey can be appreciably shortened."

•

October Electric Truck Bookings Lower

Domestic bookings of electric industrial trucks and tractors during the month of October, 1943, totaled 402 units, according to figures released by the Industrial Truck Statistical Association, 208 S. LaSalle Street, Chicago.

The net value of chasses only booked during October totaled $1,986,921.20 compared with $3,943,962.40 in September.

The October bookings included 6 non-elevating platform trucks with capacities and chasses base prices ranging from 4000 to 6000 pounds and $1930 and $2040, respectively, and a total net value of $12,130; 365 cantilever trucks with capacities and chasses base prices ranging from 2000 to 14,000 pounds and $2200 to $9185, respectively, and a total net value of $1,665,908.20; 2 heavy-duty tractors with chasses base price of $1755 had a total net value of $3510; 30 crane trucks with capacities and chasses base prices ranging from 3000 pounds at 7 feet to 10,000 pounds at 5½ feet and $5480 to $8150, respectively, had a total net value of $209,390; and 1 special truck with capacity of 4000 pounds and a base price and total net value of $5983.

• All net values are at factories after additions and deductions for variations from standard specifications and trade-in allowances, when applicable.

•

Apprentice Training for More Manpower

To keep abreast of the ever-present demand for new workers, there was an enormous expansion of training programs

This Pipe Line's an Acrobat

These days an army travels on its gas tanks. That's why it's so important for mechanized forces to have portable pipe lines with flexible joints...pipe lines that can do acrobatics.

Ordinarily, you know, pipe lines are buried in the ground and are so rigid that going through rugged terrain requires a lot of real engineering.

But there's no time for that on beachheads and at the front. Pipe lines have to be laid fast...and they can't fail, even if they're strung across rivers, ravines, or deep gullies. They must yield to the force of concussion, yet never leak.

Right there is where Victaulic Couplings* equipped with synthetic rubber gaskets come in. They're easily applied. They permit a high degree of leeway in the laying of the pipe lines.

In the invasion of Africa, for example, pipe lines with Victaulic Couplings made it possible for our mechanized forces to be sure of an adequate supply of oil and gasoline while advancing fast and far across rough ground.

As our armies progress, these rubber elbows in the steel arms that carry essential fuel will play an increasingly important part.

**Product of Victaulic Company of America, 30 Rockefeller Plaza, New York*

VICTAULIC COUPLINGS* are at work in many coal and metal mines far below the earth's surface and on hundreds of ships on the high seas. The flexible gaskets molded by United States Rubber Company resist a wide range of temperature changes, and can be used with safety on, above, or below the ground.

THE VICTAULIC GASKETS, of synthetic rubber, are impervious to the destructive action of high octane fuels. Victaulic Couplings can thus be used for pipe lines that convey oil, water, air, sludge!

THE FLEXIBLE SEAL of the flexible joint. Victaulic Couplings provide flexibility in pipe lines made of long lengths of rigid metal pipe. The flexible seal is formed by these gaskets, molded from synthetic rubber.

• • •

Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E. W. T. Carl Van Doren and a guest star present an interlude of historical significance.

1230 Sixth Avenue · Rockefeller Center
New York 20, N. Y.

UNITED STATES RUBBER COMPANY

From Parts Prints to Press in 8 Weeks

—No small task in these days of priorities, delays and last minute changes. Barth of Cleveland gives high credit to

"HARDSTEEL" DRILLS

which enabled them, on the signal equipment dies illustrated, to save many man hours and to keep an important delivery date. « « «

With a "HARDSTEEL" Drill in an ordinary drill press and following simple instructions regarding speed and pressure, any mechanic can easily drill clean holes through steel hardened by any process—40 Rockwell "C" or harder.

A time saver when last minute emergency changes come through on hardened dies and parts. And the only way to assure matching of hardened parts at assembly—drill after hardening.

Used throughout industry for parts recovery and for production work—made in all sizes ⅛" to 1".

BLACK DRILL COMPANY
1400 EAST 222nd STREET • CLEVELAND 17, OHIO

"YOU HARDEN IT... WE'LL DRILL IT" with HARDSTEEL

Complete information and practical operating suggestions in the "HARDSTEEL" Operating Manual. *Copy free on request.*

"HARDSTEEL"
DRILLS · REAMERS · TOOL BITS · SPECIAL TOOLS

during 1943, according to the Apprentice-Training Service of the War Manpower Commission.

Two different kinds of apprenticeship systems are in operation—area-wide systems and individual plant systems. The former cover on an average as many as 30 employers in a city, county, or larger area, whereas the latter are designed to train apprentices employed by only one company. Short-term programs, under which new recruits are trained for work of limited skill on the production line, are established on an individual plant basis.

Annual inventories of the apprenticeship and short-term training systems recently published show the increase of both these types of training programs by industry and trade in each state, and the name and location of each company which has adopted one or both of these programs, in the twelve months ending November, 1943.

A copy of these statistical inventories, and further information about apprentice training programs may be obtained by writing to Apprentice-Training Service, Bureau of Training, War Manpower Commission, Washington, D. C.

•

WPB Civilian Needs Census to Be Repeated

To keep close watch on actual shortages, the War Production Board has set up plans for a second census of civilian needs.

The new check-up will be more comprehensive and more specific than the first, Dr. Austin Grimshaw of WPB's Office f Civilian Requirements, has announced. Grimshaw again will head the census, which is slated to begin in early spring.

As a result of the first survey of fields in which civilians reported hardships due to wartime restrictions, some entirely new production programs have been set up, others have been expanded, and some which had been keyed too high have been reduced.

•

Proposed Wage Policy for Technical Workers

Following its recent national convention, the Federation of Architects, Engineers, Chemists, and Technicians made public its recommendations for a national wage policy for technical employees. This federation notes that in the war period the inequities in salary rates, which date back to depression days, have been accepted by the National War Labor Board, and frozen as prevailing rates. It is to offset such inequities that this organization calls upon the Office of War Mobilization and the Office of Economic Stabilization to execute the following salary policy:

"1. Establishment of a nation-wide stabilization program for technical employees. This stabilization program should provide for (a) a uniform classification system as a basis for determining salary

NEW FREE BOOK tells how to keep fire-fighting equipment in shape

Omaha Public Library
Reference Dept.

When fire strikes at your plant — will your extinguishing equipment be *ready?* A clogged nozzle, a cylinder not fully charged — these and dozens of other results of negligence can make your fire-fighters useless when you need them most. Regular, systematic inspection is the only way to make sure your equipment's in fighting trim.

To help you set up a maintenance system in your organization, Walter Kidde & Company has prepared a booklet — "Inspection and Maintenance of Fire Extinguishers." It tells how to check whether you have the proper types and quantities of extinguishers; how to mark them for quick identification; how often the various types should be inspected; what parts to examine on each unit. It suggests simple forms for keeping records. This booklet is on the press now. Write for your free copy today.

WALTER KIDDE & COMPANY, INC., 227 MAIN STREET, BELLEVILLE, N. J.

Don't be Penny Wise and Pound Foolish
ELIMINATE DUST
Parsons OVAL BAG
DUST ARRESTORS
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A clean plant is a profitable plant and Parsons Oval Bag Dust arrestors have for over a quarter of a century been mastering not only dust problems in all types of plants but in many cases actually paying for themselves.
There are many reasons for Parsons Ovals popularity some of which are to be found in their advanced engineering features such as: patented Oval Filtering Bags, Non-Rusting Arrestor Case, Simple Texrope Drive, Heavy Duty Welded Hoppers and others.
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scales and to bring order out of chaos. Archaic classification systems, such as those in federal civil service, should be revised in keeping with the need for a nation-wide stabilization program; (b) guaranteed annual salaries; (c) compulsory compensation for all overtime at the rate of not less than time and a half; (d) dismissal pay; (e) patent protection and renumeration for contributions to technology.

"2. Establishment of a stabilization committee to execute the stabilization program. This committee shall have representatives of FAECT and the technical societies, industry, and government."

•

Expert Help Available for Post-War Planning

American business men will be able to call on outstanding experts in manufacturing, marketing, sales, finance, management, and engineering to help them effect an expansion of post-war production and employment to unprecedented peacetime levels. According to Marion B. Folsom, treasurer, Eastman Kodak Company, and chairman of the Field Development Division of the Committee for Economic Development, these experts have organized to make their knowledge freely available to all in publications and by direct consultation through the 1100 community committees of CED now at work in all states.

There are six major functions or aspects of post-war planning to be undertaken by an industrial or manufacturing firm—and it is on these six functions that CED's new program is based. The functions are:

1. Organization of the firm's over-all planning program, including defining and placing of responsibility in such a way that it will not interfere with war work.

2. Analysis of products, their redesign, or the addition of new products.

3. Analysis of markets, and the planning of sales and advertising programs.

4. Planning for production facilities required to produce expanded post-war volume.

5. Estimate of number of employees needed for expanded post-war volume and the necessary employee training program.

6. Analysis of financial requirements for reconversion and expansion for post-war business.

Further information can be obtained from the Committee for Economic Development's new headquarters, 285 Madison Ave., New York 17.

•

Aircraft Schedules Still on the Upgrade

Staggering statistics, even when viewed in simple black and white, the production figures on U. S. airplane output promise

What the product designer learned from the hen

"THE lowly hen," said a famous product designer, "sees to it that *the container is part of the product.* It is a very wise thing for her to do. And we can benefit by doing likewise."

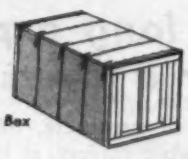
While that was a keen observation, it is just what many designers and manufacturers have been doing for years. General Box engineered containers are functional parts of many products, from the production line to the point of use or installation. They are used on assembly lines to speed production . . . in some plants to reduce assembly time . . . by other concerns to lower delivered costs.

If your plans for reconversion do not include *a container that is part of your product* it will pay you to get the facts—to find out how you, too, can get the competitive advantages which General Box Company containers afford. Write today.

Redesigning one part of a product to lower the cost of another:

A large manufacturer of home appliances redesigned his product, adding twenty-three cents to its cost. This change simplified the packing to such an extent that the cost of the General Box container was reduced by seventy-nine cents— NET ANNUAL SAVING FORTY-SEVEN THOUSAND DOLLARS.

General All-Bound Box



General Rock Fastener Box

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General BOX COMPANY

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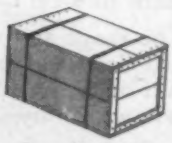
DISTRICT OFFICES AND PLANTS: **Brooklyn, Cincinnati, Detroit, East St. Louis, Kansas City, Louisville, Milwaukee, New Orleans, Sheboygan, Winchendon**

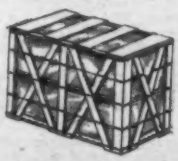
Continental Box Company, Inc.: Houston, Dallas



General Nailed Box

General Cleated Fibreboard Container

General Wirebound Crate



DESIGNED to deliver the GOODS

Photo — Courtesy Consolidated Vultee Aircraft Company

STANDARD CONVEYOR COMPANY is able, through long experience, to specify and build for a diversity of handling needs . . .

A procession of products, of the widest imaginable variety, is pouring off assembly lines today — on time, or ahead of schedule — because Standard Conveyors are helping to channel the flow of production. Whether the rate of manufacture is several hundreds a minute or one an hour, Standard builds the right type of conveying equipment to meet the situation.

The range and versatility of Standard Conveyor equipment is the result of nearly 40 years of close contact with inside-the-plant transportation — in plants large and small, making products as widely diverse as steel or cosmetics. The benefit of this experience is available to you, without obligation.

The counsel of Standard Conveyor engineers is valuable in deciding on the right kind of conveying equipment to "deliver the goods" faster—at lower cost — now or for postwar production. *Write for comprehensive reference book — "Conveyors by Standard"—Catalog No. FM-2.*

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GENERAL OFFICES: NO. ST. PAUL, MINN.

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shattering defeat to the air forces of Japan when translated into action in the air.

America's aircraft industry, which produced 5 planes a day in 1939, 20 a day in 1940, and 50 in 1941, hit an average of 300 in 1943. Moreover, the bulk of the output in those earlier years consisted of light training planes, whereas today's production runs more heavily all the time to complex fighters and bombers. The comparison in tonnage and dollar volume between those years and 1943 would thus be even more staggering than the total numerically.

Moreover, our colossal aircraft production machine is still on the upgrade. Charles E. Wilson, WPB vice-chairman, recently revealed that 1943's total output of 85,946 warplanes will be topped by 15,000 in 1944. The trend of aircraft production during 1944 will be toward a reduction of trainer and certain other types and an increase in the urgently needed combat types. "Actually, 1944 combat planes are scheduled in production for an increase of more than 50 percent above 1943 acceptances," Wilson said. "As smaller tactical models and certain types of trainers are removed from the program, the factory space and labor thereby made available will, to the maximum extent practicable, be used for subcontracting work for the assembly lines of the companies building large combat types.

"The anticipated increase in efficiency of the aircraft industry, based on the accomplishment of the last part of 1943, will permit this accelerated output with relatively small additional over-all manpower requirements, although substantial in some areas."

•

Single Labor Agency Proposed to AFL Leaders

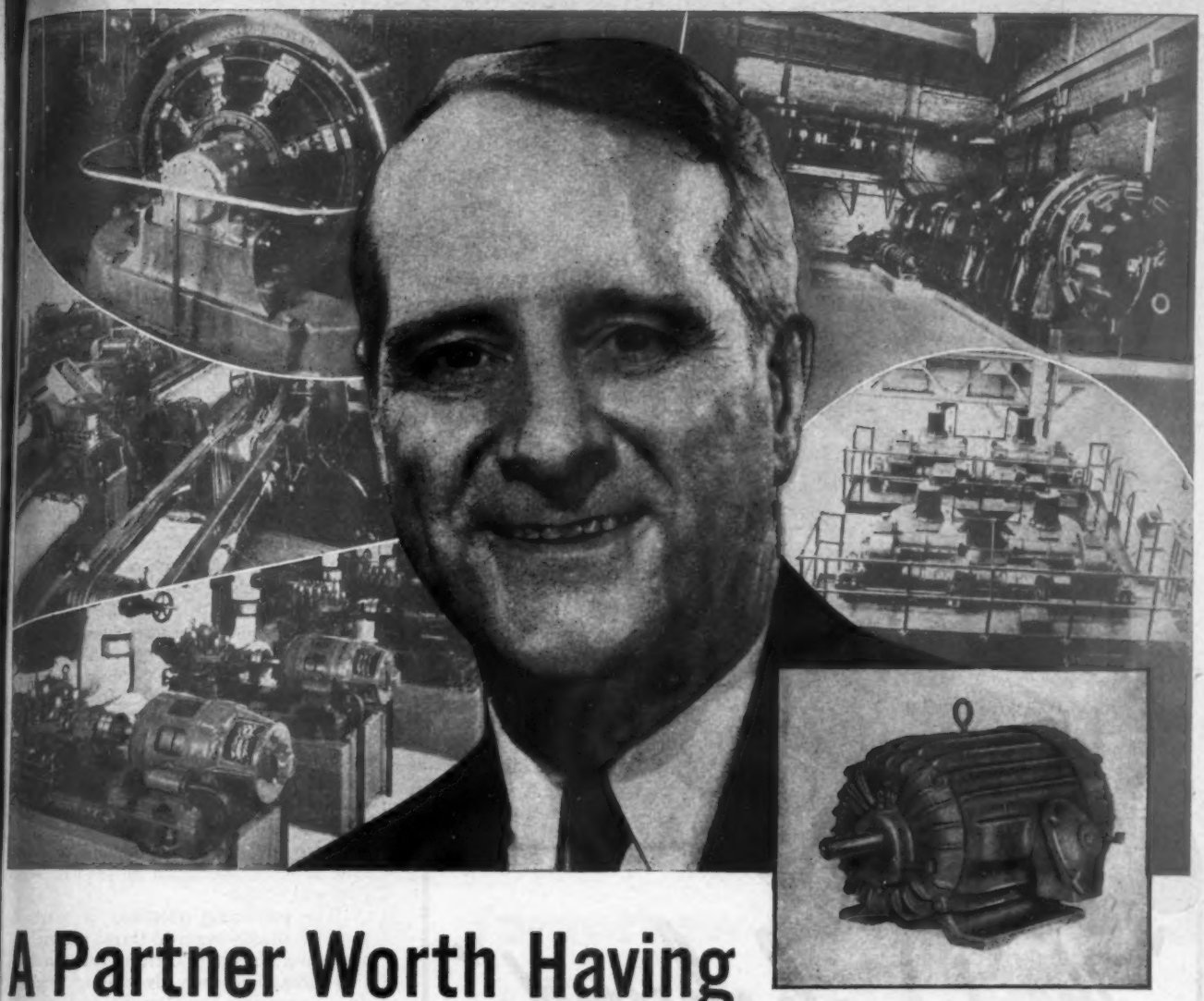
One government agency to regulate wages, conditions of employment, and other labor matters, instead of the 25 agencies and divisions that now share parts of the problem, will go a long way to solve America's industrial relations dilemma in the opinion of John P. Frey, president of the American Federation of Labor's metal trades department.

As matters now stand, Frey recently told the executive committee of AFL at its annual meeting in Miami, "American labor has been forced to contend with an almost impossible administrative" situation because national labor legislation had not been enacted which "would provide a definite labor policy and its unprejudiced administration."

In addition to the 25 agencies dealing with labor matters, there are, according to Frey, "personally advertised, self-appointed individuals busying themselves advising government representatives, and some labor leaders unfortunately have listened to them with harmful results."

Confusion and misunderstandings are the result of the conflicting policies laid down by these various agencies, Frey contends.

Contrasting the situation in the United States with that of Great Britain, Frey said that in Britain all labor questions are



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One of our men will be glad to discuss with you any motor or generator problem. While your plans are still in the blueprint stage is the time when his assistance can be most worthwhile. Write, wire or call on us at our nearest office.

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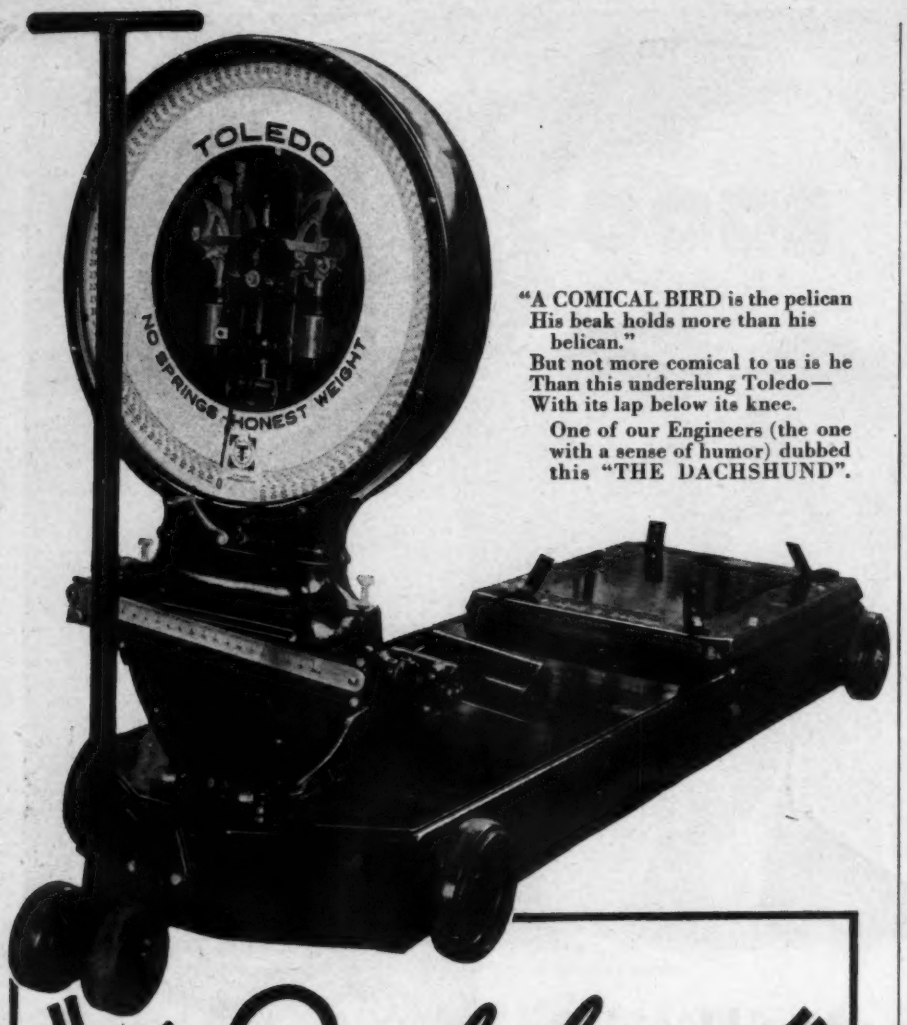

"A COMICAL BIRD is the pelican
His beak holds more than his belican."
But not more comical to us is he
Than this underslung Toledo—
With its lap below its knee.

One of our Engineers (the one with a sense of humor) dubbed this "THE DACHSHUND".

"The Dachshund" Weighs War Birds

● Toledo Research had no part in whelping "The Dachshund." It was designed by our Production Engineers to weigh the tails of war planes. It illustrates the versatility of Toledo Scales in solving special weighing problems.

Toledo Research itself is the coordinated program of continuous study and investigation carried on by the scale industry's most experienced research staff—a prewar program which was ready with many urgently needed answers to the problems of Industry-at-War.

Toledo Research, postwar, will also be ready when Industry-at-Peace faces new problems of weighing, and force-measuring. Toledo Scale Company, Toledo, Ohio.

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TIP FOR TOMORROW

PRINTED Weight Records will become universal in Industry, postwar. Hundreds of war plants are using them. We are at liberty to send you complete information now.

cleared through the Ministry of Labor, whereas in the United States, the Department of Labor had been shorn of its most important bureaus by the time war began.

Frey believed that centralization of all labor functions in one government agency would diminish the number of strikes in wartime.

•

Swapping Manufactured Goods for Raw Materials

To conserve diminishing resources at home and to lay a broad base for international trade which will help to insure peace, the United States should import all the iron, copper, zinc, bauxite, and other critical materials it can get abroad, according to William L. Batt, vice-chairman, War Production Board. Such a policy, by providing a medium of exchange for our manufactured goods in world markets, would also bolster employment after war production comes to a halt, he said..

The problems of reconversion that face industry this year will be more difficult than the conversion from consumer goods to war production in 1942, Batt believes. Military output will probably run 10 to 15 percent greater than in 1943, but this "does not involve much of an increase above the present rate" because of the way production has been stepped up since the start of 1943, he said. Believing that the defeat of Germany seemed "fairly probable for sometime in 1944, and Japan in 1945 or '46," Batt said:

"The perplexing questions of a return to peace already begin to thrust themselves aggressively forward. Cutting back production—sometimes actually closing a plant down, canceling some contracts here and there, failing to place new ones—these are happening on a small scale today, but they are likely to be more widespread—just how much, it is impossible to say."

•

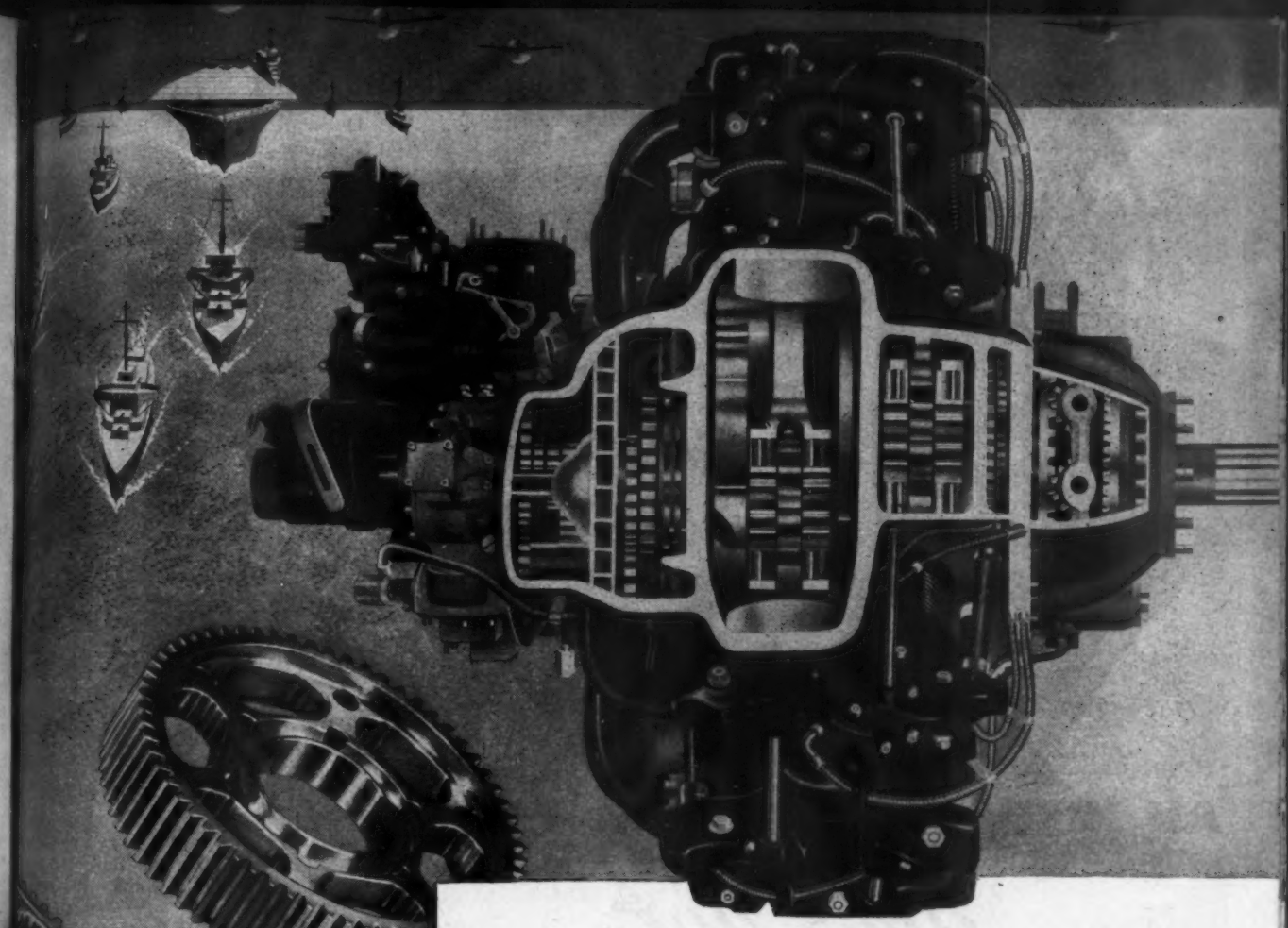
Industrial War Machine Needed After the War

Outspoken Charles E. Wilson, executive vice-chairman of the War Production Board, wants the United States to keep its industrial war machine—and its military machine too—running smoothly and ready for action at any time, after the war. Thus, Wilson believes, we can prevent future wars.

The former General Electric president hammered hard at the theory of "disarmament," which he branded "a thoroughly discredited doctrine" in an address at the annual dinner of the Army Ordnance Association in New York recently.

Wilson praised the miracles wrought by industrial top management in the nation's current war effort.

"But has it ever occurred to you," he asked, "that really good managers, in government or business, would never have allowed their own businesses to operate as haphazardly and spasmodically as has the



Tomorrow's Gears Proved in Today's Laboratory . . .

EVER look inside a Twin Wasp engine? Here the power of 1200 horses is packed in a space no wider than your outstretched arms.

And notice the gears in this mighty engine—gears so compact and necessarily so light in weight that only extreme precision makes it possible for them to carry their tremendous load.

In the three precision gear plants of Foote Bros. new manufacturing methods, new technical developments plus the skill and "know how" of Foote Bros., engineers are today producing these high precision gears in amazing quantities. Outstanding developments in heat-treating and carburizing—an exact metallurgical control—the latest improvements in gear checking instruments—all these plus the skill a knowledge of a force of experienc men and women numbering more th 6,000 assure volume production these metallurgically and dimensic ally perfect gears.

Tomorrow when victory is ours, precision gear production achieved the plants of Foote Bros. promi American manufacturers a new ec omy in the transmission of power. in compact speed reducers and airc devices—in marine motors and g trains as well as in Pratt and Whitr engines, these precision gears are day showing the way to new standa in engineering which may be devo to peacetime production when the w is won.

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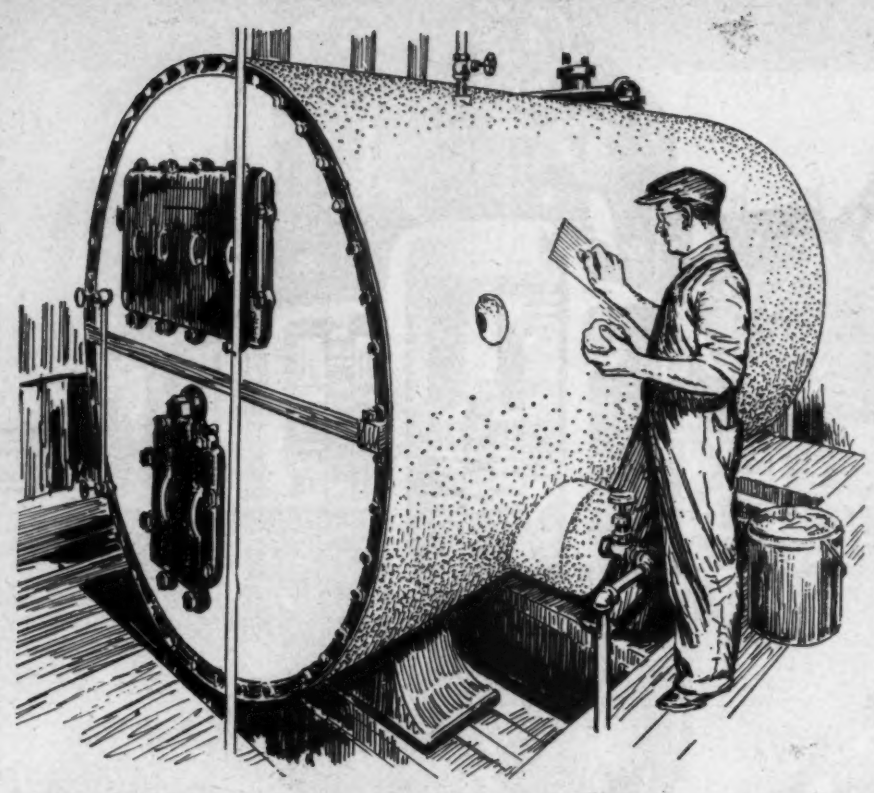

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Once it's on, it's on to stay — and that means real savings in time, money, and materials.

Baldwin-Hill No. 1 Insulating Cement contains a special rust-inhibitor that prevents corrosion between metal surfaces and the cement. Whether the cement dries out immediately on a hot surface, or air-dries over a long period of time, it will not affect the bond. Ordinary expansion and contraction of the insulated surface are not problems, either. B-H No. 1 Cement is elastic enough so that it will not crack and peel.

Made of B-H *black* rockwool, it is effective up to 1800° F. It is the ideal maintenance insulation for valves, fittings, and large pieces of equipment where molded-type insulation is not practical. Makes an excellent finish, too, for covering blanket and block applications. Send for sample and information.

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business of defending the United States against its enemies?"

He pointed out that, in industry, market trends were watched from year to year, always with an eye on future needs. Yet when it comes to the vastly important and tragic business of war, "we shut our eyes and stop our ears until it is so late that top management has to perform miracles, and men die while waiting for them."

Wilson asked his audience to consider, for instance, how many lives, and how much money, could have been saved if the anti-submarine devices now available had been ready in the summer of 1940.

"Perhaps it is time for some fresh thinking on this matter of war and peace," he continued. "Instead of looking to disarmament and unpreparedness as a safeguard against war—a thoroughly discredited doctrine—let us try the opposite—full preparedness according to a continuing plan. The thought may be unpleasant, but through the centuries war has been inevitable in our human affairs, as a basic element in evolutionary peace. We have yet to learn that hard truth, apparently."

Wilson declared that industry's cooperation with the Army and Navy during the last two years had made a "very effective combination," one which he advocated be extended into the post-war period.

"Should the world know that we were in that position," he said, "that we were determinedly keeping the fires of scientific and developmental effort burning, and that we were ready to shift our industry quickly to the production of these thoroughly tested and proved superior weapons, the probabilities of another Hitler, Mussolini, or Tojo undertaking to conquer the world will be much more remote."

Industrialists Are Leaders

Speaking directly to the industrialists in his audience, Wilson told them that they, as much as generals and admirals, legislators and chiefs of state, were leaders of their country, and that "their responsibility for post-war preparedness is certainly no less."

"The burden," he said, "is on all of us to integrate our respective activities—political, military, and industrial—because we are in world politics to stay whether we like it or not."

To carry out the ideas he advocated, Wilson submitted a "rough outline" of a program. He suggested that first of all the preparedness program be made the responsibility of the federal government, that it be a continuing program, and not "the creature of an emergency," and that the program be "insured and supported" by Congress.

Industry's role, he said, should be to "respond and cooperate" and be allowed to play its part unhampered "by political witch hunts or thrown to the fanatical isolationist fringe, tagged with a 'merchants-of-death' label."

He recommended dividing industry's role into two parts: Research and production. Great emphasis should be given, he continued, to the research activities of governmental agencies and the services as well as industry.

To develop this program of research, Wilson believes that competent, respon-

HERE IS ONE OF INDUSTRY'S MOST IMPORTANT TOOLS

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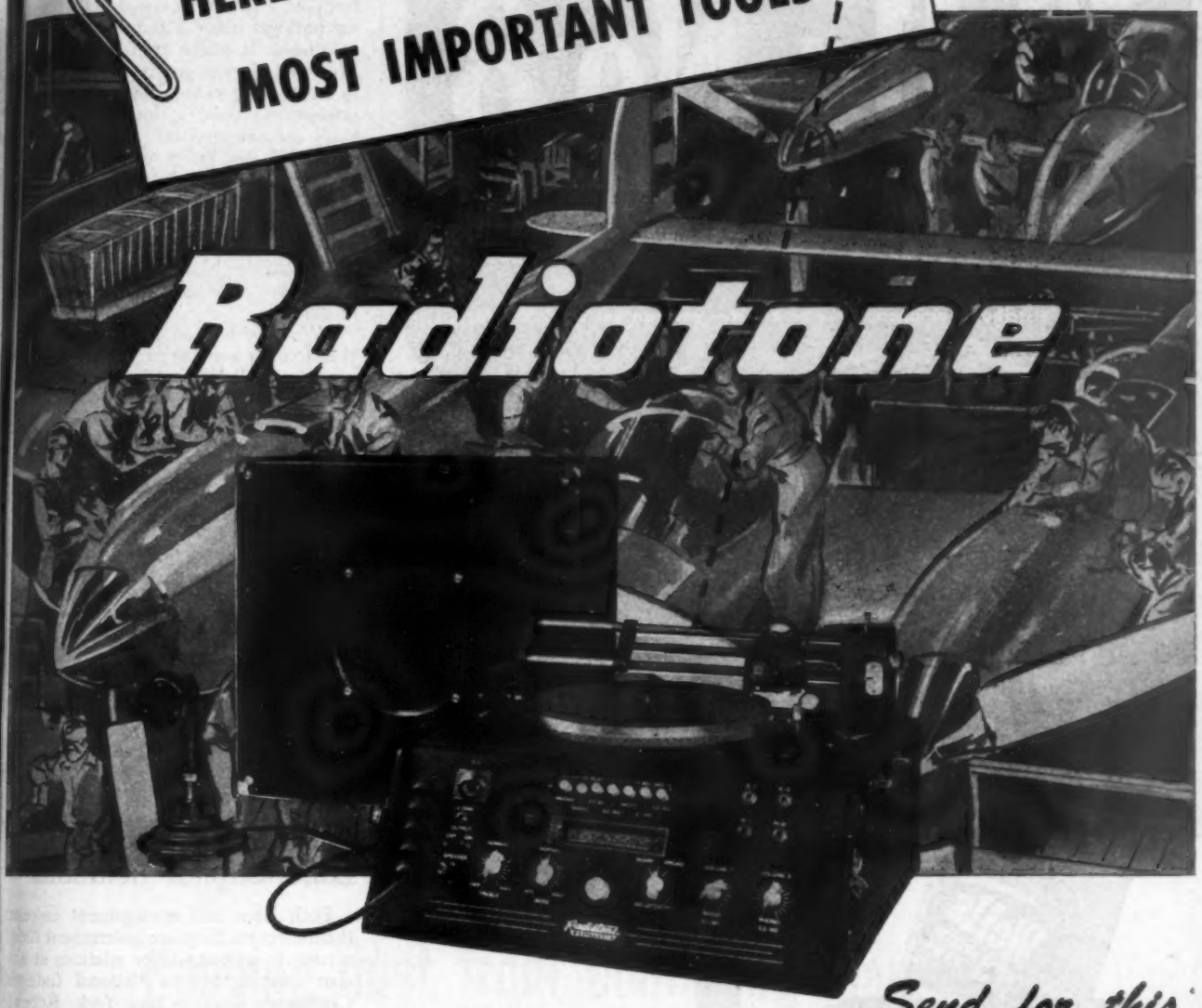

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THE FAST METAL CUTTING SAW

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Wells Saws are working on the production line — in the tool room — on maintenance and odd jobs — cutting metals and other materials with speed and precision. Wells Saws are rugged, versatile machines built for today's tough cut-off problems. And they will be the ideal all around saws for tomorrows jobs too!

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sible civilian advisers should be named to institutional committees that could maintain liaison with industry and government laboratories.

The chairmen of such committees, with ranking Army and Navy officers, then could compose a general committee for continuing post-war research and development, he continued. It might even be wise for the Army and Navy to give reserve commissions to outstanding industrialists to insure their interest and build a closer bond between them and the services.

Out of this group of officers, Wilson said, an "industrial coordinating committee" might be chosen to serve in conjunction with the principal procurement officers of the services, thus providing a group that would carry into peacetime the consultative idea of the combined chiefs of staff.

"We have learned that our country has the strength and brains to do anything it needs to do," Wilson declared, "provided that it brings the strength and brains together and makes the proper use of them. As we love peace and long for its continuance, it is our responsibility to make sure that America's strength and brains, its craft and knowledge, are kept forever ready —not just ready for action, but in action."

The importance of his plan, according to Wilson, is that in keeping the United States "scientifically and technologically ready for war" it would not be necessary to maintain large armed forces, nor would it be necessary to depend upon universal military service.

"It can fit into our peacetime way of living without difficulty." Wilson concluded. "I believe with all my heart that it would guarantee that way of life."

•

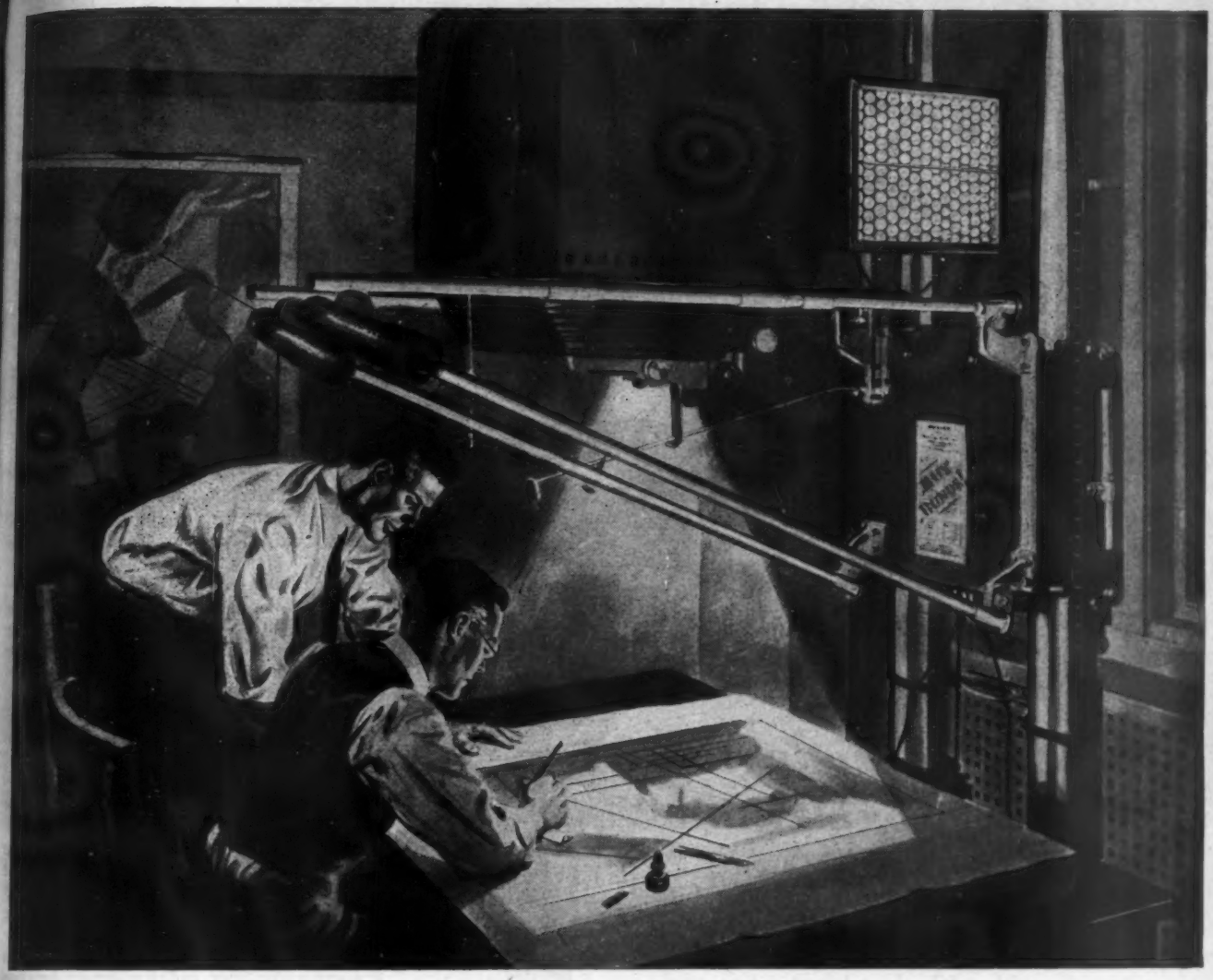
Government and Post-War Labor-Capital Relations

Both labor and management expressed themselves on the place government should occupy in post-war labor relations at a recent meeting of the National Industrial Conference Board in New York. Robert J. Watt, international representative, AFL, spoke for labor, H. W. Prentis, Jr., president, Armstrong Cork Company, presented management's views.

"I think the place for the government in post-war labor management relations should be that of a second spare tire, always available if needed, but actually never needed under normal operating conditions," said Watt.

"The relationships of labor and management in collective bargaining are essentially those of two parties making a simple contract and keeping it," he continued. "This relationship is dependent upon a free forum and fair dealing unhampered by one-man czars, anonymous spokesmen, and bureaucratic preachments.

"Long ago the industrial employer hired a new worker by direct negotiation, each making such offers and conditions as he wanted, and then making counter-proposals until they came to terms upon which each would agree. . . That process was not substantially different from other contracts, whether the buyer and seller were trading horses or hiring a piece of land. There was



Keeping dust from confusing map makers

THESE MEN are tracing maps from photographs taken by aerial cameras.

The photos are enlarged by the device shown at the top and projected on the table shown below. Every tiny area on the photographic print is important. Some may be enlarged to reveal recognized landmarks... or expose vital enemy targets.

Dust specks, too, when enlarged, would take on strange shapes—confuse the map makers. For this reason, special care is taken to prevent dust from getting on the prints. The Dust-Stop* Air Filter (shown at upper right) strains out any specks of grit, dust, or lint—keeps them from getting into the projection machine and settling on the photographs.

The above is merely one interesting application of Dust-Stops to specific war jobs.

Where else are Dust-Stops being used?

Today these air filters are providing clean, filtered air in many war plants making precision parts, bomb sights, communication systems, and delicate subassemblies. They are used in paint-spray booths and scores of other places where manufactured dusts must be controlled or outside air cleaned before it is circulated.

Consider this low-price advantage

As original equipment for industrial installations, Dust-Stops cost only about 1¢ per CFM to install. Their replacement cost is less than 1/10th of 1¢ per CFM.

Ask your regular supplier about Dust-Stop Air Filters. If he cannot give you complete technical data, write to *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. In Canada, Fiberglas, Ltd., Oshawa, Ontario.*

ARMY E NAVY

FIBERGLAS*

DUSTOP

*T. M. Reg. U. S. Pat. Off.

AIR FILTERS

"No lips but yours shall ever touch mine"

Industry has gone for Dixie Cups in a big way, because of the protection they bring to workers' health. Used but once and thrown away, they never pass along colds or other illnesses.

This was never more important than in the present crisis, when sick absenteeism must be combated all along the line.

For water service at the cooler, or on the job, as well as for quick, clean feeding in the plant, Dixie Cups are a proven asset in plant efficiency.

Dixie and Vortex Cups are made at Easton, Pa., Chicago, Ill., Darlington, S.C. and Toronto, Canada.

We suggest you keep on asking for Dixie Cups even though they are hard to get. We're doing our best to catch up. The war-needs come first, then our old and regular customers. So keep on asking —maybe next time your Dixies will be available.

DIXIE CUPS

DRINKING CUPS AND FOOD CONTAINERS

no need for the government to interfere except when a dispute arose which the parties could not settle together.

"The chief difficulty in labor-management relations arises from the fact that industry has become a mass production business. The principal usually can deal with employees only through agents. Conditions are usually subject to changing circumstances, and the contract involves the needs and emotions of human beings...

"In peacetime the self-interest of the parties is usually sufficient to bring about an agreement before the argument need cause any public intervention. If a man and wife are quarreling together, they usually can settle it without having the neighbors intervene...but if a neighbor is butting in every time either one gets excited, the prospects for bigger and better fights increase very greatly, and usually all three participate.

"In labor-management relations, it is pretty much the same story. If the employer and his employee meet together to find out and settle any outstanding differences, they usually succeed...

"The vast majority of American trade unionists are concerned because they want the system of free enterprise to continue...But if management wants the government to be a party to every detail of personnel relationships, management need only to follow the course of resistance. The end result may be to dispossess management of the right to manage...

"You can play the role of resistance until the government has been forced to take over, or we can join together and develop a program of democratic self-government for industry in which the politicians and the disjointed alphabetical agencies will be kept out...

"Free management cannot eixst unless there is free labor. Industry cannot function unless there are people to build and run the machines and to buy their products. There must be as much purchasing power as there is production, and there must be good will and mutual respect.

"In modern corporation management, unions are needed by management as much as by workers. They are the mechanism for conducting the human relations within the plant...

"Government has a legitimate function as an impartial agency to conduct elections among employees to determine their choice of bargaining unit and agency. Government has no right, however, to impose personal prejudices through the National Labor Relations Board or any other agency upon employees to cause skilled craftsmen to be submerged against their will in polyglot units in which they have no voice as to the conditions of employment.

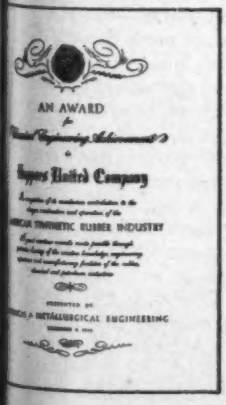
"Government has a right to say that in the public interest, an employer must recognize and bargain in good faith with legitimate employee organizations. If management denies this right and refuses to bargain, management is simply inviting an attack by any one of a number of government agencies, a painful and contagious ailment, I assure you.

"Government has a right to say that in the public interest, employer-employee agreements must not violate basic standards of health and welfare, and that, in the pub-

You will get new tires sooner because of

One out of every seven American synthetic rubber tires may be made out of materials from this plant.

this Koppers-built plant



"*The biggest job of chemical engineering in the history of the world*" is the way the American synthetic rubber program is described by the secretary of the Awards Committee which gave to the synthetic rubber industry the 1943 Award for Chemical Engineering Achievement, sponsored by Chemical and Metallurgical Engineering.

The plant pictured here is the largest single combined plant for the production of butadiene and styrene. It was built by Koppers Company for the Defense Plant Corporation at Kobuta, Pa. (The butadiene units were designed by Union Carbide and Carbon Corporation.) The plant is being operated by Koppers United Company for the Rubber Reserve Company.

For its accomplishment in erecting this plant, Koppers was one of the companies which received the Chemical Achievement award. Koppers had carried on research work and developed processes for the manufacture of synthetic rubber ingredients long before the outbreak of war with Japan.

The Kobuta plant is already producing in excess of its rated capacity and is shipping to the rubber plants more than one-seventh of the nation's production of these two synthetic rubber chemicals.

Koppers' recent records include construction of coke oven plants, gas plants, and other plants for the recovery of invaluable coal tar chemicals, as well as production of airplane catapults; anti-aircraft gun mounts; piston rings for airplanes, mechanized army equipment, submarines, etc. —Koppers Company and Affiliates, Pittsburgh, Pa.

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Basically different in design. Combines easy swiveling with long service due to special arrangement of its ball races and use of durable Bond caster metal. Pressure lubricated throughout for better performance.

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lic interest, valid agreements must be fulfilled by both parties subject to remedies in court or by impartial arbitration. And that is just about as far as government should go in connection with collective bargaining."

* * *

According to H. W. Prentis, Jr., government's place in post-war labor-management relations is threefold: (1) It should fix the rules; (2) it should administer them efficiently; (3) it should function as an umpire, not as a czar.

"In setting the post-war rules," Prentis continued, "government should keep in mind that organized labor in the United States has now come of age. It is no longer an 'infant in industry.' In the past decade it has passed through a lusty period of adolescence and must now assume the full obligations of manhood. The arguments formerly used to justify legislation and judicial decision granting special privileges to labor—because it was the underdog—no longer hold water. . . Existing statutes must be modified so as to require the assumption by organized labor of a degree of responsibility for its actions commensurate with the enormous power which it now exercises by governmental sanction and edict.

"In the past, while the issues involved in most labor disputes have been important, nevertheless they have been chiefly concerned with matters of more or less transitory character—the determination of collective bargaining units, the recognition of unions, wage scales, working conditions, etc. None of these questions strikes at the roots of the Republic. Now the situation has changed. Labor-management relations involve problems that go deep into the vitals of constitutional self-government—the right to work freely at a lawful vocation of a man's own choosing; the control of labor supply—and hence the volume of production and the scale of living—by the sort of invisible government that the closed shop makes possible; the tremendous power of labor pressure blocs on government administrative bodies; the protection of minority and individual rights in labor disputes; the financial impact of horizontal class groups on our political elections; the dilution of the power of management to control and direct private business efficiently—there are some of the portentous issues that impend in the crucial years ahead. If the rules are not set by government so that these problems will have to be worked out essentially by private organization effort—even though at great travail—the end of American freedom is not many decades distant; and management, labor, and the people at large will all find themselves crucified once more on the cross of dictatorship and tyranny. . .

"In the last analysis, government's place in post-war labor management relations will be just about what we jointly choose to make it. If management will universally and voluntarily do its utmost to make collective bargaining work successfully. . . if the labor union will regard itself as an integral part of the business enterprise in which it operates. . . America can remain the land of the free, in which our children's children can continue to enjoy the blessings of liberty long after we are gone."

It's Time to Get Light on Your Feet!

What with cancellations, cut backs and design changes, these are no days to increase surplus inventory. It's time to streamline your stocks to the utmost—to get "light on your feet" for post war operations.

To keep down your steel inventory, for instance — why not buy more from warehouse? Frasse stocks of cold finished bars, tubing, stainless steels, alloy and aircraft steels and tubing are now in good shape. By buying only what you need for immediate production, you avoid leftovers and dead stock when contracts change.

Your post war plans can be seriously hampered by heavy, awkward surpluses. Why pile up more when you have Frasse inventories handy to draw on? Call Frasse for your steel requirements first.

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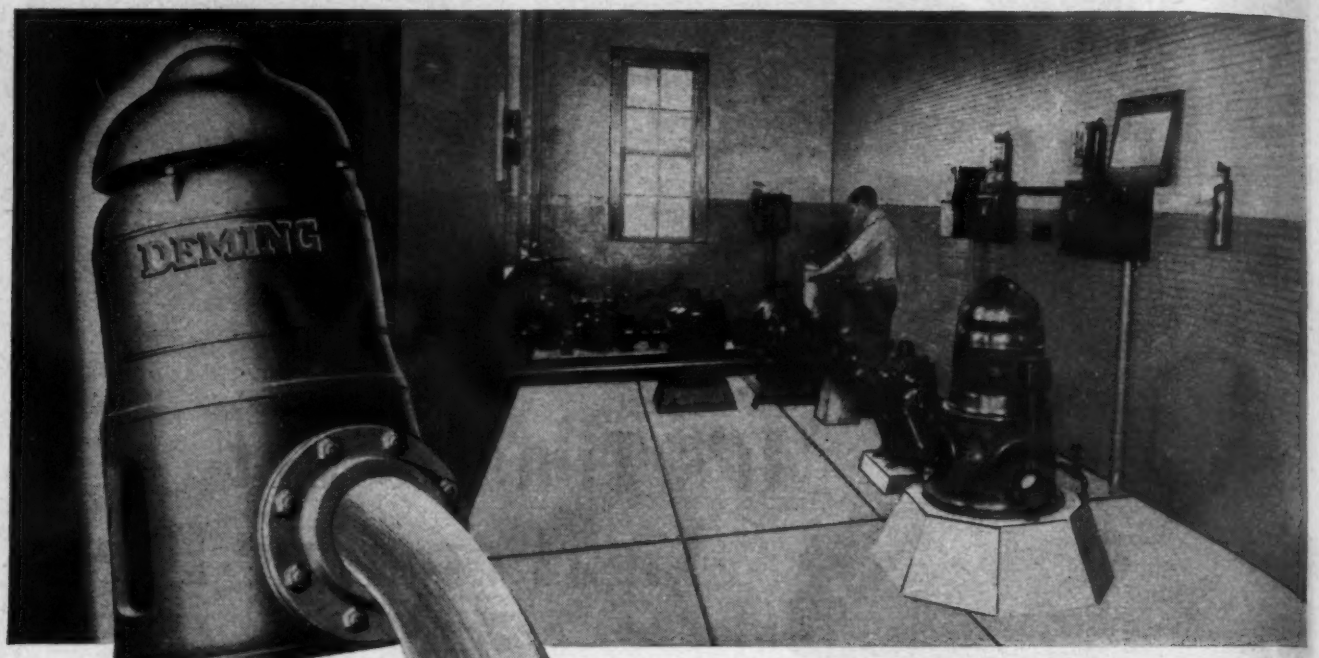

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Water Lubricated. Cutless rubber bearings flood with water being pumped.

Sustained High Efficiency. Semi-open adjustable type impellers can be easily adjusted from ground level. Stuffing box located in discharge head.

Compact. Requires minimum floor space and allows pumping unit to be placed at any depth from surface.

Selectivity. Vertical hollow-shaft motors are standard construction but practically any type of head can be supplied where required.

WATER is not a "critical material" but lack of it, or excessive cost of it, can cause critical conditions.

To help you avoid those critical conditions is the job of Deming Deep Well Turbine Pumps. Their features of design, construction and operation are coordinated to produce pumping units of exceptional dependability and economy of water supply.

Wherever water of proper analysis, quantity and temperature is available, Deming Turbines make ideal pumping units within their range of capacities from 15 to 3000 g.p.m.

Send for 20-page, illustrated Bulletin 4700-8 and list of representative companies in YOUR type of business who own Deming Turbine Pumps.

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THE COMPLETE LINE
PUMPS AND WATER SYSTEMS

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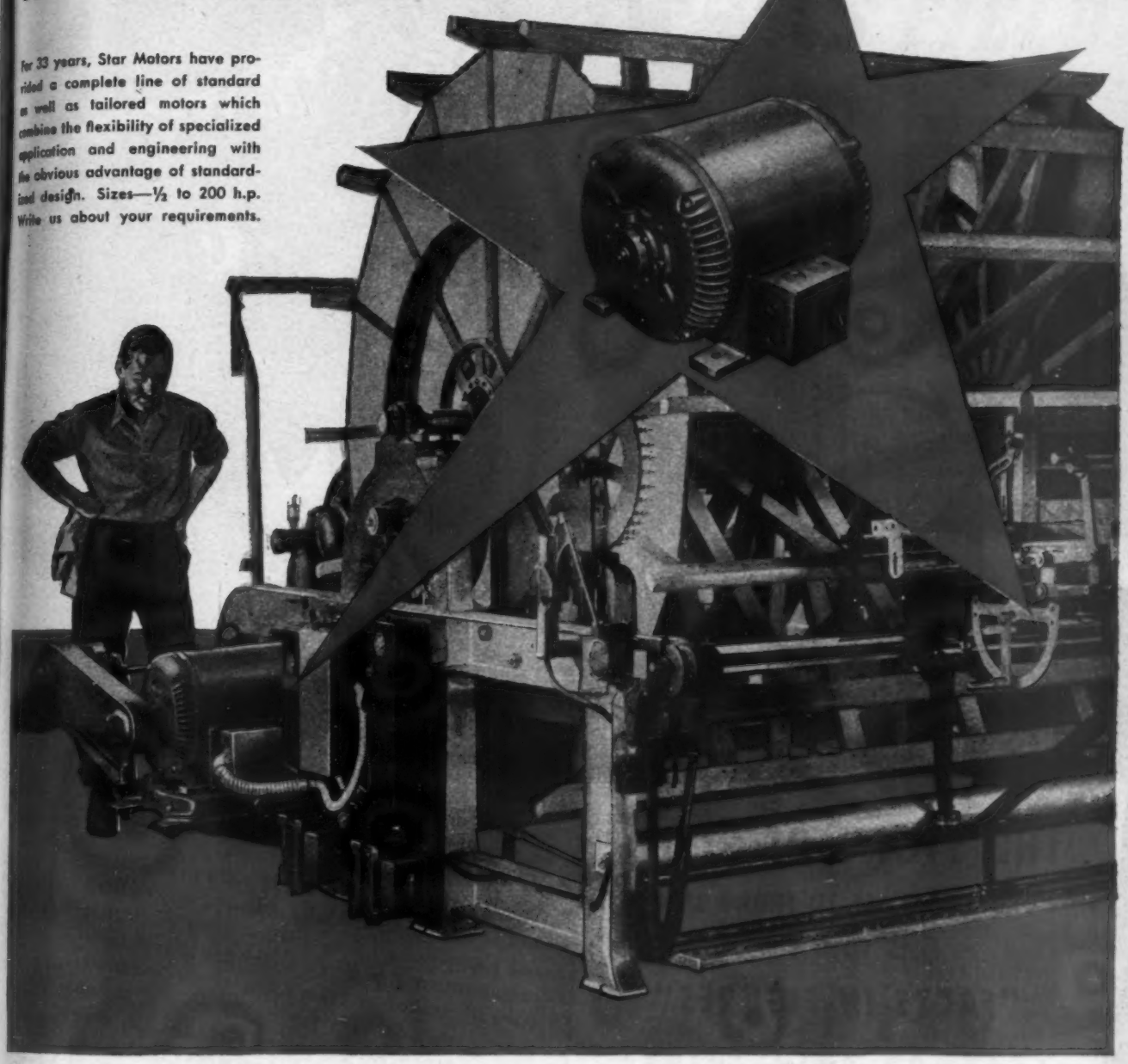
For 33 years, Star Motors have provided a complete line of standard as well as tailored motors which combine the flexibility of specialized application and engineering with the obvious advantage of standardized design. Sizes—½ to 200 h.p. Write us about your requirements.



Frequently Star is asked to fit *mechanical* "tight spots" with its unique welded construction that eliminates special patterns and castings. And just as often to fit engineering "tight spots." Sipp-Eastwood warping machines, for example, warp 500 yards of rayon, acetate or nylon a minute. To meet these high speeds, Star engineering provides motors that develop intermediate speeds in addition to the four fundamental speeds. Abnormally high torque is also provided at low speed. And all without special or costly construction. STAR ELECTRIC MOTOR CO., Bloomfield, N. J.

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POWER **PACKAGED** *AS YOU NEED IT*

STAR MOTORS

THE STORY OF STEEL

FROM FURNACE TO FIRING LINE

IS TOLD BY

"FACTS-IN-FIGURES"

In a steel mill, Control by Count begins with the ore-cars which are tallied by a Veeder-Root Magnetic Counter, as they unload on top of the furnaces. Ingots are counted as they enter the blooming mill and again counters are used as the steel enters the rolls where space between rolls must be accurately maintained. This space is visualized for the operator by motorized counters that read in thousandths of an inch, and help him to control steel-thickness. Here, too, the white-hot ingots are counted by *their* own light which actuates a sensitive electric tube.

Veeder-Root Counting Devices are also used to measure the number of feet of production of structural shapes . . . the length of any defects in finished bars . . . the number of "wraps" of steel on reels in reversing mills . . . the length in feet of total sheet produced.

Veeder-Root Counters are used for many different jobs in tube, pipe, and wire mills . . . in handling and transporting . . . to control input of electric current into mill motors, the amount of coal automatically stoked, or the amount of gas consumed. Finally, they do many jobs in the front office, on phones, typewriters, business machines . . . even helping in payroll and personnel work. Then when steel is made into tools of war, the Armed Forces take over, and Control by Count continues right up to the battle lines.

Every inch of the way, steel counts heavily on these "fighting figures" supplied by Veeder-Root Devices. And if your work is of frontline importance, then *you* can count on Veeder-Root, too.

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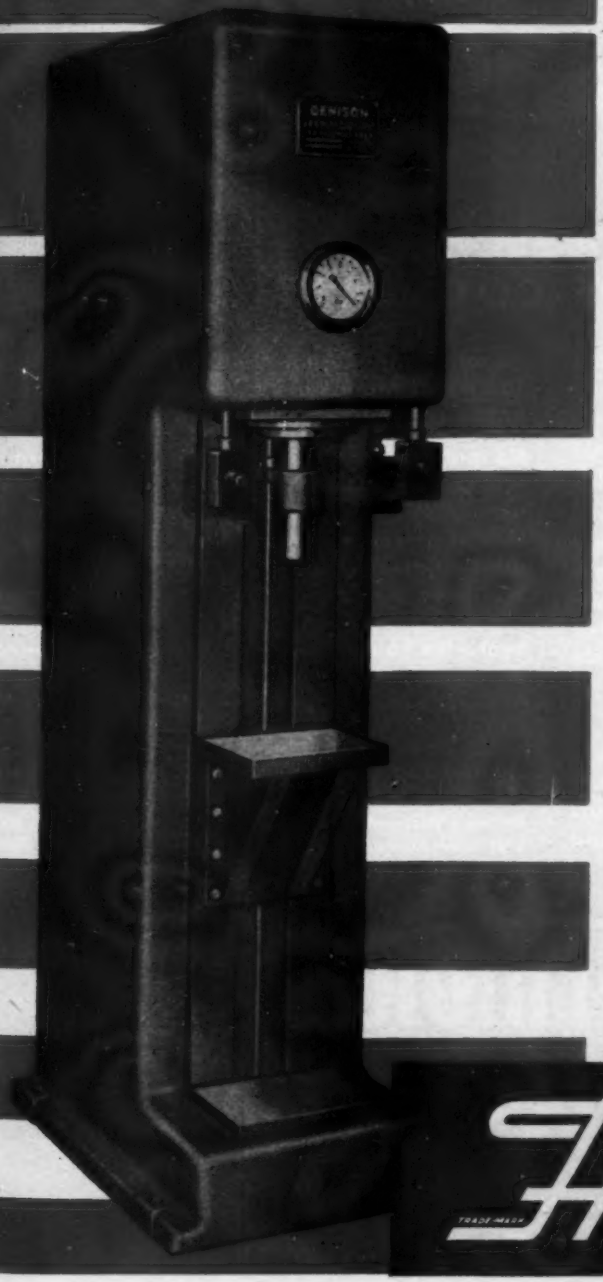
Hartford, Connecticut, U. S. A.

THE JEEP of the PRESS FIELD

Quickly Adaptable to 101 Needs



Here's a rugged knee-type press that's as versatile on the production front as the jeep is at the battlefront!

Specially designed for quick, easy changes and adjustments of tools, fixtures, bolsters and supports, it gets into action in a hurry on any number of different requirements — one right after another — with little or no time out between jobs. Yet it also delivers top efficiency under hard, continuous service on routine production-line operations.

This DLKC2 HydrOILic Press is available in 5, 15, and 25-ton capacities, with an eight-inch throat opening and a maximum stroke of 30 inches. Stroke and pressure may be pre-set by means of simple controls; or the operator, guided by the accurate pressure gage, can "inch" the tonnage upward at will, to meet special or exacting requirements. A highly compact, streamlined, fully self-contained press. Hand or foot control — or both — can be supplied. Electric control also available. Write today for full details!

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A SYMBOL OF COOPERATION

To the men and women of Thermoid, the Thermoid seal is more than just a trade mark and a product identification. It is a symbol of individual responsibility among all company employes: management, engineering, production and sales.

This concept of the Thermoid seal produces cooperation among employes. Every Thermoid employe realizes that his own business welfare directly depends upon the approval and acceptance of Thermoid Products by the user . . . that men and management who manufacture inferior merchandise also manufacture the elements of their individual failure.

The protection of this Thermoid seal is therefore recognized as the personal duty of every member of the Thermoid group. Uniformity in product manufacture, meticulous inspection, prompt and personalized attention to customers, and all of the other things that have made for consistent Thermoid progress are in large measure traceable to this concept of the Thermoid seal.

No matter what the uncertainties ahead Thermoid will continue to make the finest industrial products possible. 1944 finds Thermoid with the largest personnel and facilities in its history. We are confidently hopeful that during this year, we will have the opportunity of further demonstrating the cooperation symbolized in the Thermoid seal—the cooperation that has caused Thermoid customers to say:—*"It's good business to do business with Thermoid."*

THE THERMOID LINE INCLUDES: Transmission Belting • F.H.P. and Multiple V-Belts and Drives • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Sheet Packings • Industrial Brake Linings and Friction Products • Molded Hard Rubber and Plastic Products.

Thermoid Rubber

DIVISION OF THERMOID CO.
TRENTON, NEW JERSEY

It's Good Business to do Business with Thermoid

...REMEMBER THE CAT'S WHISKER?

The FAN is the heart of any AIR system. With a Buffalo Axial Flow Fan, the system is always up to par."

Not so many years ago the miracle that has now become common-place was truly a miracle. Sound through the ether — word-pictures of places and people — music for all — at the touch of a tiny wire on a small crystal.

Radio has come a long way, since then. From today's huge air-conditioned factories flow an endless supply of radio parts — crystals, tubes, condensers — for our armed forces on land, at sea, in the air. Radio has become not only the voice but the eyes and the ears of mankind.

Developments now in the making will present new horizons; television and two-way radio will be part of American life.

"Buffalo" fans and air conditioning equipment for the control and tempering of air have been used by radio manufacturers since the days of the "Cat's Whisker". We have had an active part in providing clean, conditioned air for the new plants in the Industry. And, right now, we are working with manufacturers who are planning for tomorrow — "When there's an AIR problem —let "Buffalo" supply the answer."

"Buffalo" "First For Fans"

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Silv-A-King "RLM" Standard Dome Reflectors

Silv-A-King "Victory" Fluorescent Units

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Silv-A-King lighting service—which costs nothing extra—includes expert guidance in planning lighting layouts for maximum efficiency, flexibility, and economy. Why not discuss your lighting problems with a Silv-A-King engineer? *And send for the complete Silv-A-King catalog today!*

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SILV-A-KING MAKES *Light* WORK FOR YOU

Organizing for Better Methods

R. B. TOMER, Supervisor of Industrial Engineering, Sylvania Electric Products, Inc., Appliance Division, Ipswich, Mass.

Recently, many people have asked the questions, "How does one get methods improvement or a work simplification program started effectively? Can it be organized in such a way that the results can be planned and scheduled? Or must it be a rather haphazard, catch-as-catch-can affair?" To the first question, "Can it be organized?" we believe that it can, provided certain fundamental primary requirements are present.

In the first place, we believe, after observing work smplification and methods at work in several plants with which we are familiar, that the most of these programs get started at the wrong end of the job. They begin by attempting to improve the actual methods and processes before the production organization, of which they are a part, has been put in satisfactory working order. In many organizations, production planning, scheduling, and materials control are considered an office or clerical problem, and time study and methods a factory or engineering problem. An effort is made to separate these two problems and make two unrelated activities.

"Flow" and "Work" Inseparable

This is a great fallacy, in our opinion. To regard the *flow of work* as a separate problem from the *work itself* is the same as regarding the flow of electric energy through a wire as a separate problem from the method of carrying the current. The amount of electrical energy, the current, the voltage, and the nature, whether it be d.c. or a.c., are all just as important factors for the consideration of the electrical engineer as the wire that carries or uses the energy. To obtain the most efficient and effective use of the electrical energy, he may increase or decrease the voltage, he may raise or lower the current, and he may decide that a.c. is more suitable than d.c. He can control and regulate all these factors, in addition to determining what method of transfer he will use. In fact, in most cases, it will be necessary for him to control all these factors before he determines the *method* of transfer, if he is to arrive at the "one best way."

Industrial engineering should look upon "work" in exactly the same manner as the electrical engineer regards electricity. Work must be controlled before it can be transformed or utilized efficiently. A great many industrial engineering programs begin by trying to improve the method of transferring work before the work itself is under complete control.

To speak more specifically, the term "work control" is more usually referred to as "materials control," but as the control of material amounts to the control of work, the two terms are really synonymous. Until the flow of material to the worker has been placed under control so that no time is lost waiting for work, there is not much point in attempting to improve the

Ammunition for today and tomorrow

"Fittings" the trade calls them. But the term tells only half the story—and the least exciting half, at that. For these carefully-made but inconsequential-looking gimmicks are vital to every mobile fighting unit whether it wages battle on land . . . on sea . . . or in the sky. They are, in fact—ammunition!

These assorted fittings have been produced by the millions-per-week for war purposes in the four plants of The Weatherhead Company. And with Victory and Peace, they will become the ammunition with which we shall be prepared to help you build the better world for which we are all fighting.

Look Ahead with **Weatherhead**

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

DUST CONTROL

A MIGHTY FORCE IN WAR PRODUCTION

• Dust Control *is* "a mighty force in war production,"—a silent partner to the mammoth machines, roaring furnaces, striving men and women. Behind the scenes in thousands of war plants and arsenals, that intrepid guardian —Dust Control—is doing a man-size job in keeping the ravages of industrial dust, soot and grime from vital machines, materials and workers.

• Such an important job as this must be complete. There is no room for partial Dust Control—for a job half done. That is too costly to meet the demands of modern industrial progress.

• Pangborn Dust Control, the result of forty years experience and research in answering industry's needs, will assure complete and exacting coverage for *your* dust problem. Use Pangborn facilities today and be sure of the best in Dust Control.

Original "E" Award received March 13, 1943. Renewal of award with white star added to banner November 5, 1943.

"Pangborn Dust Control is Protection for Production"

PANGBORN

WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

methods of doing the work. Savings that may be effected by better methods are wasted if operators are allowed to remain idle part of the time because there is insufficient material to keep them active.

Demoralizing Effect

Even if there is enough material to maintain the work, the effect upon the worker is demoralizing if he sees that the fruit of his efforts is allowed to accumulate about his machine or workplace. In either case, the efforts of the methods engineer to find better ways of doing the work seem insincere to the worker, who has common sense enough to know that all is not well. One remark often heard by the foreman under such conditions is, "You get us the material and we'll show you how to get the work out without any of your high-sounding ideas!"

The control of the flow of work is far from a mere clerical routine, even though it may depend for its continued success upon paperwork systems. The development of these systems, the coordinating of many departments into a smoothly working unit, and the breaking down of routines into as many automatic functions as possible constitute a major engineering undertaking.

How inclusive should materials control be—where should it begin and end? We believe that materials control should begin as early in the cycle as possible and end as late as possible, and that there should be no break or interruption in the system at any point in between. In some plants this will mean starting with the vendor or subcontractor and ending at the shipping point or in the customers' hands.

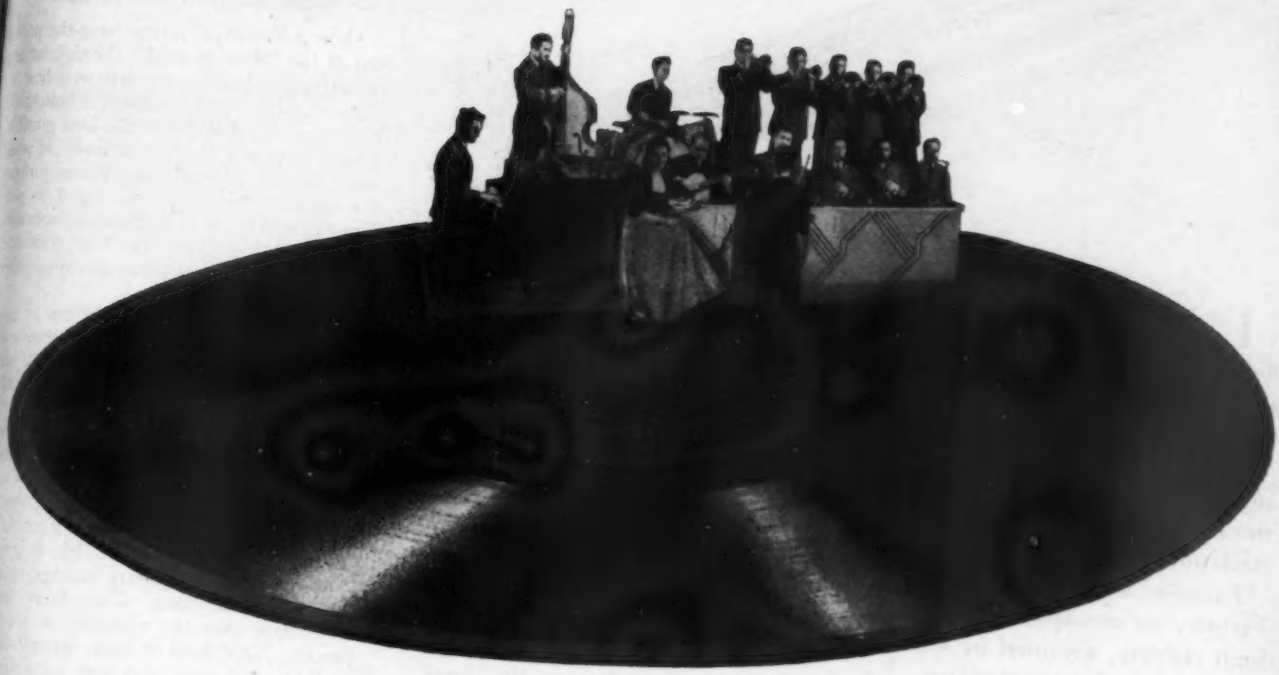
Must Really Control

Many excellent articles have been written recently outlining the principles to be followed in setting up a good materials control system. The one point that we feel is of the utmost importance in any system is that it should actually *control* materials—all *materials*. It should be simple and foolproof. It should be fully automatic, and depend for its success upon a variety of small decisions and operations rather than upon large individual decisions or personal skill. This latter consideration is in the interests of ease of replacement of personnel. In these times any system that depends upon the skill of any one individual for its success becomes, sooner or later, a liability to the entire organization.

After a system of materials control is in operation, and idle time due to lack of material has been eliminated, it is time to look at the physical side of the "flow of work." The term, "flow of work," implies that work moves through the plant. This is true in the broader sense, because, as we have already pointed out, material and work are practically synonymous—without material there is no work. Therefore, the next point to be studied and placed under control is the movement of work in the plant. Material travels from one department to another; it travels from one process to another; and it travels from one operation to another, all in the course of what we call the manufacturing process. In some plants

A Record of Performance

. . . THAT WINS INDUSTRY'S APPLAUSE!



Like a giant orchestra, all of Industry plays a symphony of Victory. The blare of the starting whistle, the blast of the furnace, the rhythm of the riveting gun, the melody of the saw and hammer, the precision of the lathe . . . all these, rendered on a giant scale, will help to strike the final note of Victory!

Quite naturally, we're proud of our performance in 1943 . . . a record in tune with America's rising crescendo of production. That we hope to play an encore in the months to come goes without saying, for Levinson Steel is constantly seeking and developing new ways to improve and speed its service to Industry.

THE LEVINSON STEEL CO.

Warehouse Steel Products—Fabricated Structural Steel

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Levinson Steel Sales Co., Sales Agents

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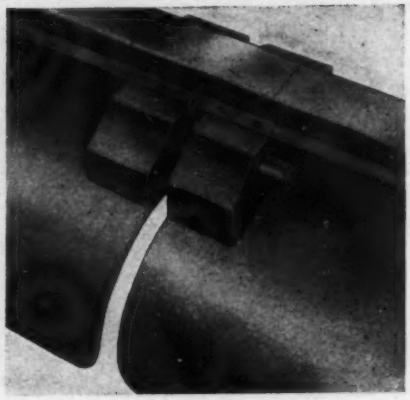
Check The Details—
See why Wheeler means
"Skilled" Lighting!

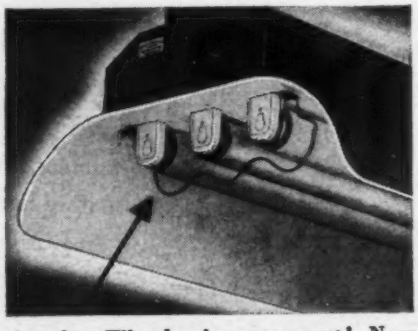
From end to end, Wheeler Reflectors are engineered with all the skill and experience of Wheeler's 62 years' specialization in lighting. They're "skilled lighting" that insures maximum lighting efficiency, durability, and convenience of installation and maintenance.

Examine a Wheeler Fluorescent Fixture, for example. Compare its high rigidity, obtained in spite of WPB metal-restriction, by Wheeler's I-beam wiring channel construction. Notice that wiring is *completely metal-enclosed*, yet instantly accessible. Also note the accessibility of starter switches; the speedy adaptability of the unit to continuous runs; and the ample provision of knock-outs for any type of mounting.

Whether you need fluorescent or incandescent fixtures, specify Wheeler and you'll get such "skilled lighting"! **Wheeler Reflector Co., 275 Congress St., Boston 10, Mass.** . . . New York City. Representatives in principal cities.



Simpler Wheeler coupling speedily adapts single units to continuous runs. Note I-beam wiring channel design and accessible starter switches.



Another Wheeler improvement! New Lamp Retaining Guard for modern fluorescent fixtures. Provides new safety . . . positively prevents falling lamps.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

this inter-process or inter-operational movement is left largely to chance or to the willingness of certain workers to get material when it is needed and to supply others. This "movement of work" can rightfully be called a further extension of the problem of materials control, but it is often so intimately tied up with the internal functionings of the department, and with the operator, that it is considered a part of the operation or process.

Again we take exception to this practice of regarding the "flow of work" as being a separate problem attached to each individual job. "Flow," it seems to us, is one of the over-all considerations that must be viewed in conjunction with the process as a whole, and not as many individual pieces of the whole.

Continuous Flow Is Best

There are many ways of solving the problem of the "flow of work" throughout an industrial process. No one system is best in all cases. One thing, however, is almost always true, and that is that the best possible flow of work is a continuous flow. If work must flow at all, what possible argument can there be for ever permitting it to stop flowing, except as a part of the necessary processing? Even then, the ideal condition would permit processing to continue while flowing.

This, of course, points to the use of continuous flow conveyors and progressive assembly methods. In industries where such an arrangement is possible, we believe that the ultimate in "flow control" can be achieved. Where certain conditions force a departure from this principle, we believe it should be as little as possible. Every time you depart from continuous flow, certain undesirable elements appear. First is an extra handling operation. This is usually followed by a temporary storage, which wastes valuable space. Then there is loss of control over the material or work-in-process. This leads to large inventories of partly worked goods and poor regulation of subsequent operations. Wherever you have these temporary storages, the control is no longer at the start of the process. A new control is necessary at each storage reservoir. This increases the overhead and also the chances of error, with consequent stoppages of work. Every argument points to the advisability of keeping the work moving in a steady, uninterrupted flow.

Controlling the Work Itself

Having properly controlled the flow of work, we are ready to control the work itself. It is at this point that the average methods program begins. We have not followed this procedure because we have felt that the other conditions should be met and controlled first. Now we have arrived at the point where we are ready to look at the work itself and study the methods of doing it. We have a plan of organized attack which, we believe, produces the greatest results in the shortest possible time.

We are getting a little ahead of our story on one phase of the program. During the study of the flow of work it becomes necessary to determine at least one thing about the work itself. What is our atti-

"Turning Points" to Victory

Official Signal Corps photo

HUB-DEEP in war

Bad roads to the battle-front can obstruct advance as effectively as exploding enemy shells. Yet, these sturdy wheels gain their objectives because they turn on ball bearings — trouble sealed out — friction-free power sealed in.

News readers thrill to accounts of bombs blasting and machine gun bullets spattering — but a commanding general's ear is tuned to the music of motors, to powerful wheels churning through sand or mud, in cold or heat, to bring more and more men, ammunition and supplies to move the tide of battle ever forward.

Friction, ignored, can bring a whole war machine to a grinding, smoking stop. But it can't happen to our side because ball bearings have been placed at every "turning point". They are pre-designed to keep at bay every hazard of terrain, temperature, speed or load — and they're making good along with the fighting men who operate them.

Some day, the smooth, full-powered punches delivered by Fafnirs in ships, planes, guns, trucks and tanks will lead to the final Axis-knockout. And from this tough testing ground will emerge the Fafnir Ball Bearings on which peacetime machines and vehicles will turn. They will serve you as dependably then. The Fafnir Bearing Company, New Britain, Connecticut.

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ALL around the clock this post-war gadget takes down telephone messages and repeats 'em . . . with no wrong numbers . . . whenever the hard-worked executive gets back from the Club.

Ingenious little electrical device, isn't it? It may be a long time coming . . . but when it does the smart manufacturer will include Cannon Connectors in its intricate make-up. Bet on it that wherever electric current is carried and there is need of quick, positive connections a Cannon Quality Connector is bound to fill the bill. And there's nothing better to be had.

Cannon Battery Connectors—like the GB-3-34B receptacle and GB-3-21B Plug shown here—are adapted to general industrial uses as well as quick disconnect of engine starting units in aircraft. Besides wartime uses, Cannon Connectors are standard in scores of industries . . . radio, television, lumber, aviation and motion pictures, to mention only a few.

CANNON ELECTRIC

Cannon Electric Development Co., Los Angeles 31, Calif.

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CANNON ELECTRIC

REPRESENTATIVES IN PRINCIPAL CITIES—CONSULT YOUR LOCAL TELEPHONE BOOK

tude to be towards the amount of work done in each operation? Obviously, a product could be manufactured by one individual doing 100 operations or it could be manufactured by 100 individuals each doing one operation. Which of these two methods is the better way?

Where to Stop Subdividing

Almost everyone will agree that we are all more or less committed to the latter method in industry today—100 operators doing one operation each. But how far can we carry this type of thinking? Why not 200 operators or even 500? There must be a point of diminishing returns beyond which it becomes uneconomical further to subdivide the total process.

What are some of the factors that will help us to determine where this point is? First, why do we subdivide the process at all? Modern industry is committed to specialization rather than to generalized skill. Chief among the reasons for this is that an operator learns part of a process quicker than he would the whole process. This is an aid to training and allows people of low general skill to acquire a high degree of skill in one phase of a process. It also makes for flexibility in the manufacturing process. New models or methods are difficult to install where an operator is responsible for an entire process. He has too much to relearn.

Another reason for subdivision of the process is to reduce the work to a point where it can be studied and controlled efficiently. Adequate tools or jigs are virtually impossible to design when the operation is long and complex. And, if they are designed, a minor change in the product will often make them obsolete. Supervision is difficult where a long, complex process is being performed by one operator. These are some of the many reasons for subdividing the process, but they give no answer to the problem of how far we should subdivide. Many physical things can limit subdivision, such as available space, but actually there should be only one real criterion. Subdivision can be economically carried down to the point where "set-up" and "break-down," or "make-ready" and "put-away," become a substantial part of the actual operation. In machine controlled operations, subdivision of the process must end when idle machine time becomes an important factor. In any process, however, it is our opinion that subdivision should be carried down to the lowest point consistent with good results, or until some good reason prevents further division of the work.

Analyzing Jobs in Action

After deciding at what point subdivision should stop, and after standardizing on some workable arrangement of operations that will accomplish this subdivision, we are now ready to analyze the jobs in action. Much can be done to improve a process while in a static state, but nothing compares with the results to be obtained from observing the actual results of the method being tested while working under production conditions. We believe that the engine must be running before you can adjust the carburetor intelligently. And so it is with

CLOSE CONTROL

makes a big difference in Upson bolts and nuts

• Every single step in the manufacture of these fine headed and threaded products, from the processing of the iron ore to the final finishing operation, is under the *CLOSE CONTROL* of *ONE* integrated organization—Republic Steel.

Hence, consistent uniformity of product. The full-formed, sharp-cornered heads that provide snug wrench fit. The clean, sharp threads that run freely—hold tightly. The shanks of accurate size that slide through bolt holes easily—that possess needed strength.

These features of Upson Quality mean fast assembly, less waste, sound bolted joints, lower costs.

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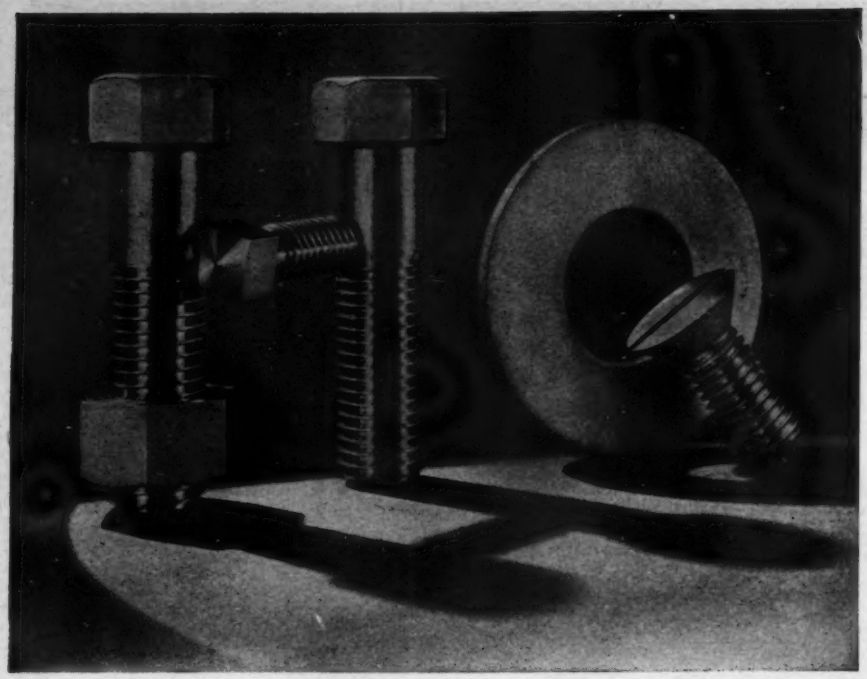

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an organized approach to the methods improvement or work simplification problem. Before you can make consistent progress in this direction, all of the contributing factors to bad methods must be eliminated or controlled, and the process must be set in motion. Operations must be balanced so that each operator is doing a fair share of the task and then, and only then, should a systematic search be started for the one best method of doing each and every job.

Methods Are Standardized

Methods should be standardized and frozen by specifications—not to hinder improved methods, but to retard promiscuous methods changes until the effect on the whole process can be observed. The improving of one job in a sequence so that it outruns the others in the same sequence only defeats the objective of materials control or "work control." It can accomplish nothing until this saving, due to better methods, has been integrated with the rest of the operations and spread over the whole process.

This is not an argument against better methods or work simplification, but rather a plan to use these tools effectively, in an orderly fashion, and in such a way that the effects are beneficial to the entire process rather than to one section only.

One characteristic of so many methods programs is the "hit-or-miss" approach. There is seldom any organized method of approaching the problem. Ideas are allowed to crop up at random and usually the most obvious and the easiest problems are tackled first. What we propose to do is to "call our shots." We prefer to plan our methods improvements and time them just as we should plan and time new developments in product design or in production scheduling. We believe that improvements in individual methods that are not planned may at times be actually wasteful from the over-all standpoint of materials control and supervision. On the other hand, organized or planned improvements can be made a most effective tool of management and one which can give definitely predictable results every time.

Our plan for accomplishing this is not difficult or hard to understand. We have already used it in several instances with marked success. It is a sort of "triple play," using time study, motion study, and methods training, all in one carefully planned attack.

To begin with, our plan calls for maintaining a methods standard for every productive operation in the plant. Before a new model or a specification change is put into production by the process engineering department, it is reviewed by the methods engineer and the standards engineer. A method for producing the new unit is agreed upon, and a set of temporary standards is drawn up, based upon some real and some synthetic time values. Because of the need for speed, and lack of experience with the particular product under consideration, it is not always possible to work out the one best way at this stage of the development. But a satisfactory method is arrived at which will allow manufacturing to proceed at the earliest possible moment and in a reasonably efficient man-

This CRAWLER is Different!

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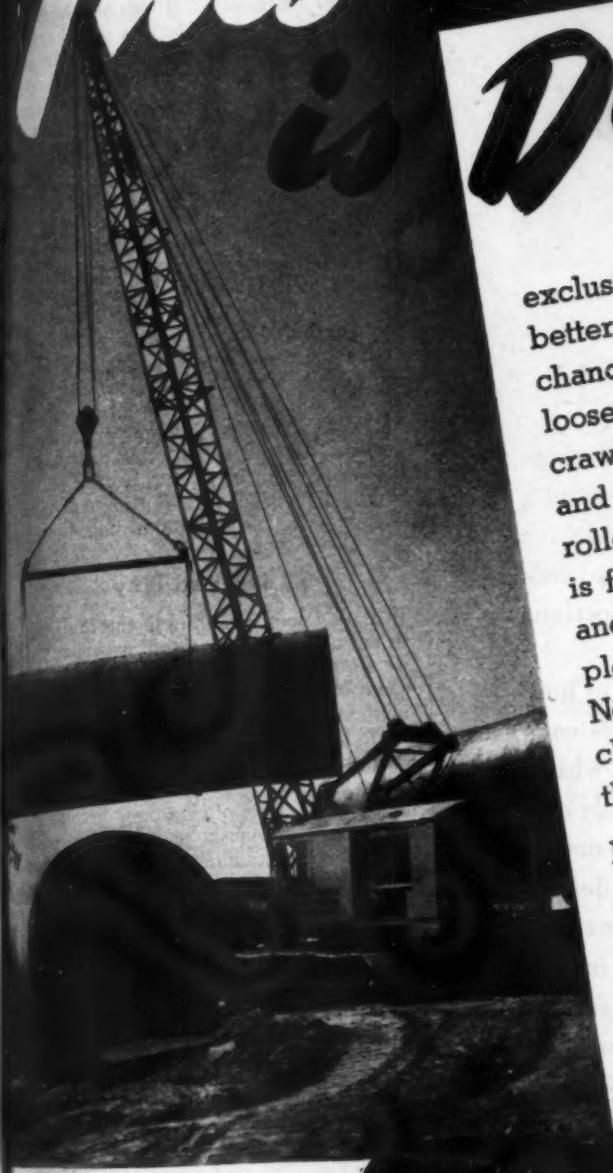

It is just one of the many exclusive features that makes the Northwest a better yard crane. All gears are enclosed. No chance to pick up scrap metal, wire or other loose material so often found around a plant. Small crawler rollers give each tread shoe a bearing area and prevent the jamming up of treads between rollers when crossing rails and timbers. Steering is from the cab regardless of the cab's position and without swinging the cab. Easy control and plenty of power makes it possible to maneuver a Northwest alongside a car, up a ramp, through close quarters or between piles of material with the same smoothness as driving a truck.

Let's get acquainted! There are lots of other features that are exclusively Northwest. We'd like to tell you about them. Why not let us send you complete details for your post war plans.

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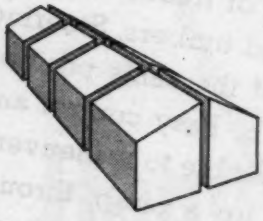

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Postwar factories will be built from pre-fabricated steel panel sections for speedy erection, even with unskilled labor. They will be durable and firesafe.

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Postwar warehouses will be constructed of pre-fabricated steel panel sections, and can be easily disassembled for removal to new locations with 100% salvage.

MANY of the famed LST ships which have played so vital a part in American troop invasions have been assembled in shipyards from pre-fabricated steel sections made by International.

This is another example of how the urgency of war compels construction improvements which will affect the future. Already our engineers are using their newly acquired experience to design pre-fabricated steel sections for quick assembly of postwar industrial buildings. "Buildings in packages" for every industrial purpose will be the practice at International Steel Company after the war.

Learn more about this postwar method of steel construction. Write for our lastest literature—now.

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Evansville 7, Indiana

ner. These standards are complete operation instructions for every operator in the line. They show right- and left-hand motions, the work-place arrangement, and the allowed times for each element. These allowed times are computed to assure a balanced amount of work at each work station in the process.

These temporary methods standards go into production with the new model or the specification change and serve as the instructions to the operator during the "breaking in" period. After production reaches planned output—usually about a month to six weeks—we introduce the second phase of the attack. During the month, under actual operating conditions, the methods engineers have been reviewing all the temporary methods standards and have been studying every job minutely, taking motion pictures studies of many of the more complex or difficult ones and checking them in the laboratory.

The methods engineers' assignment is to reduce the total manufacturing time wherever possible by using all the principles of motion economy and work simplification. By the end of this first month they have many new ideas worked out in the methods laboratory, but none of these changes has gone into production.

The Third Play

At this point we bring in the third play in our attack—training and classroom projects for our production supervision. With some ideas in mind as to what the final methods will be, as a result of the studies made by the methods engineers, we bring the foreman and the line leaders who are supervising the production of the new model into a series of classroom discussions. They have previously had JMT or work simplification training—if not, they are scheduled for this immediately—and are acquainted with process charts, operator charts, and motion study. We assign to them definite operations that have given us trouble, as a classroom projects for group discussion. Under the guidance of a trained conference leader, we work out our solutions right then and there. We also take that opportunity to let them discover for themselves the benefits of any new methods that the methods engineers may have worked out.

In the end we have studied every operation in the process under nearly ideal conditions. We have seen it in operation without interruptions due to material shortages, poor transportation, or flow problems. We have frozen its development long enough to get a good view of the entire process, and we have carefully sifted every element in the process for "hidden gold." Finally, we have sold this "one best method" to the people who must live and work with it by letting them work out the "bugs" with us, and even to better the experts wherever possible.

We feel that this procedure is really scientific methods improvement or work simplification and that its results will be much more lasting and satisfactory than the more transitory nature of most hit-or-miss methods programs. We have given it the acid test—it has been tried, and it works.

"WELL I SWAN! JOHNNY SAYS HE'S DRIVING A DUCK!"

"DEAR GRAM: They got me driving a duck. It's a great big thing. Bigger than Rigotti's moving van and it's got a propeller in back so it can operate on water as well as on land and . . ."

Land Sakes, Johnny! How would Gram know that the "duck" you're driving is an *amphibious truck* and not one of her feathered friends?

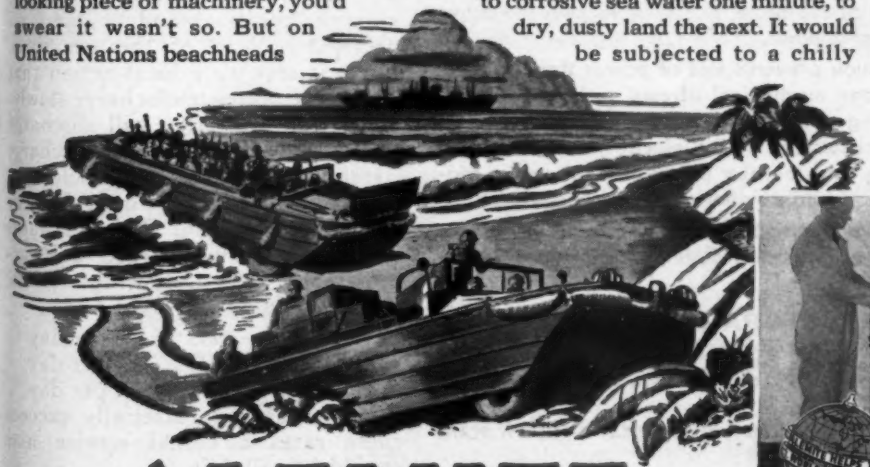
Five years ago if you saw this weird looking piece of machinery, you'd swear it wasn't so. But on United Nations beachheads and battlefields you see plenty of "ducks" today . . . speeding supplies from ship to shore . . . waddling inland with precious cargo . . . fording streams . . . zipping along roads.

Because the "duck" operates on water *and* land, many new and difficult problems arose during its development.

One of them was lubrication. For, here was a truck that would be exposed to corrosive sea water one minute, to dry, dusty land the next. It would be subjected to a chilly stream and seconds later be highballing along a sun-baked highway.

The problem was solved . . . *in a hurry!* And the "duck" is just one of thousands of pieces of fighting equipment where high-pressure lubrication is helping to hasten victory.

Alemite, as the pioneer in high-pressure lubrication, is devoting its years of experience in automotive and industrial lubrication to the needs of war. Ashore, afloat, in the air, Alemite lubrication systems and equipment help guard our fighting machines. From the smallest fitting to complete lubricating departments on wheels, Alemite is on the job . . . on every battlefront on earth.



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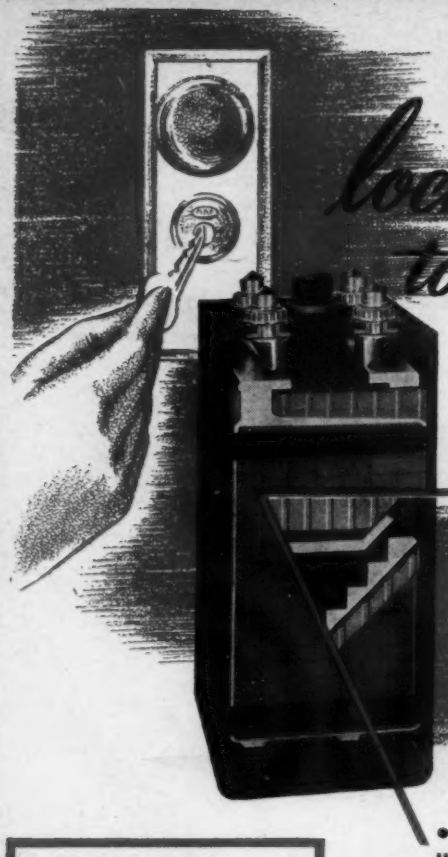
Keeping a production line humming like a "duck" is often a matter of protecting vital parts by means of correct lubrication.

One of the lubricating devices developed by Alemite is the Lubrikart . . . a compact, portable pressure lubricating unit mounted on its own truck. Brings needed lubricants direct to machines—services them completely, dependably with metered delivery. Has its own air compressor or connects from air line.

If you have a problem in the handling or application of lubricants, most likely the Alemite Lubrication Specialist near you can be of tremendous help. Write, wire or phone us, today. There is no obligation.



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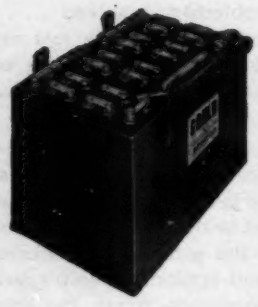

Rated conservatively . . . Goulds equal or exceed in capacity any battery of comparable size and cell structure.

Are you receiving the monthly informative "Gould Battery News"? If not . . . ask for it.

• The life of a storage battery depends upon the length of time the active material is retained within its grids. For years shedding, the loss of power producing active material from the grids, caused premature failure, and it was not until Gould pioneered the spun glass mat for American battery users that ordinary battery life was greatly increased.

Made to a formula that is still exclusive with Gould, these spun glass mats are placed on each side of every positive plate. Here, after a few months of service, they actually become a part of the plate, *positively locking the active material in place.*

This fusion prevents loss of power through electrical and mechanical abuses, such as improper charging and rough handling. It also permits a freer circulation of the electrolyte to the plate surface and thereby provides still another reason for Gould's higher sustained capacity.

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SELF DISCHARGE

One of a series of service suggestions for users of industrial batteries.

◀ Self discharge is the tendency of a battery to lose power during the period when it is not in active service. It is primarily dependent upon the type of plates used, although the purity of the electrolyte can be a contributing factor.

There are two general types of lead cell batteries. In industrial trucks, Diesel starting, automotive and other uses, where the emphasis of design is on light weight, small bulk and high capacity, batteries with pasted plates are almost universal. In the better stationary installations, where neither weight or bulk represents a serious problem, solid lead or Plante type plates are favored.

With the latter type, particularly when the positive plates are made entirely of pure lead, as in the Gould Plante, self discharge is not an important matter. However, in pasted plate batteries which employ grid frameworks to hold the active material in place, it becomes a serious problem. This is especially true if the battery must stand idle for any great length of time.

Antimony is the secondary metal commonly alloyed with lead to give grids the necessary strength to hold active material in place. During charging operations, a small amount of this antimony usually dissolves from the positives and is plated on the sponge lead of the negatives. There it sets up a local action that causes the plates to discharge slowly.

All lead batteries will discharge when standing idle. They discharge faster when warm than cold and this loss is greater in an old battery than in a new one. This discharge on a good, fully-charged unit approximates the following specific gravity readings:

at 100° F.—.003 S.G. per day
at 80° F.—.002 S.G. per day
at 50° F.—.0005 S.G. per day

If self discharge materially exceeds these rates a Gould service man should be called in.

Normally self discharge is not important to battery users who cycle their equipment frequently. However, it represents a big factor when selecting a battery for floating installations. The Gould Plante is preferred for this service by many engineers because its positive plates are of one piece pure lead construction, that contains no antimony.

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Hurtling at top speed over rough terrain, fighting dust and dirt as well as enemy shell fire, even the toughest of tanks may occasionally call for mechanical first aid.

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An essential tool in the mobile shop is the lathe. We are proud that one of our wartime assignments is to supply South Bend *Precision* Lathes for these indispensable units in America's motorized army.

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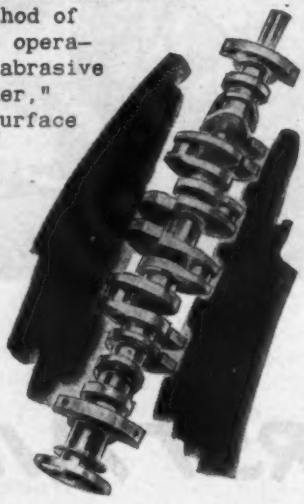
1 It has an interesting, complex oscillating motion. It works up and down following crank contours. And it does it all at once! It's the darndest machine you ever saw! Yet it is one of the most efficient and productive machines of its type. Its job is to finish all of the bearing surfaces on a crankshaft at one fell swoop! The older method of performing this same operation is to hold the abrasive cloth in a "nutcracker," finishing only one surface at a time.



2 With the new machine, strips of successively finer grits of abrasive cloth, having serrated edges to permit the strips to follow the fillets of the bearings, are automatically inched past the revolving crankshaft from a feed roll of the cloth. And on many a job it's Aloxite Brand cloth by Carborundum that gives the ultimate smooth, satin finish.

3 Further improvements in techniques of grinding, finishing, sharpening and polishing, developed through the facilities of The Carborundum Company, will be helping to produce still more for less, now as well as in postwar period. Remember abrasive products are "Weapons for Production." Use them wisely. The Carborundum Company, Niagara Falls, N. Y.

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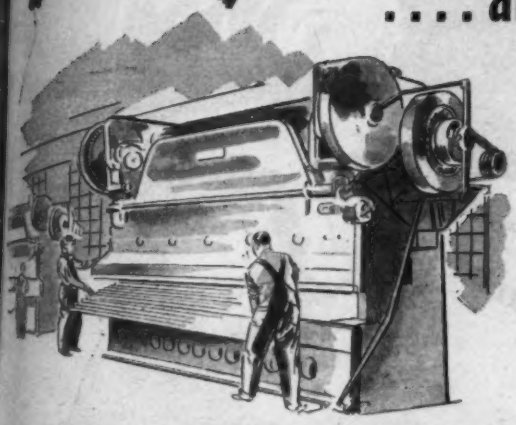

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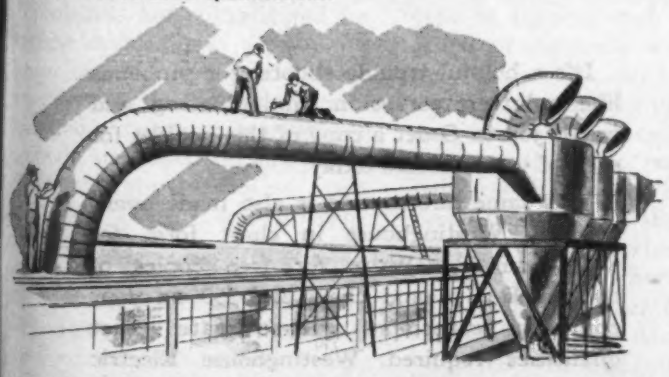

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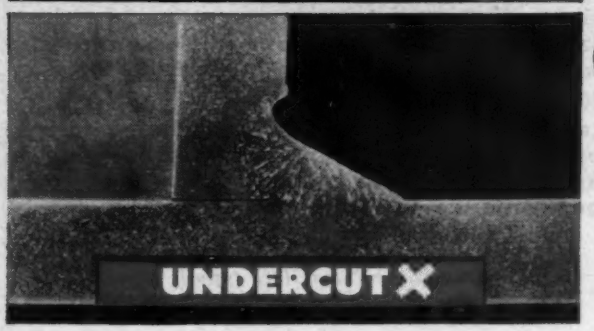

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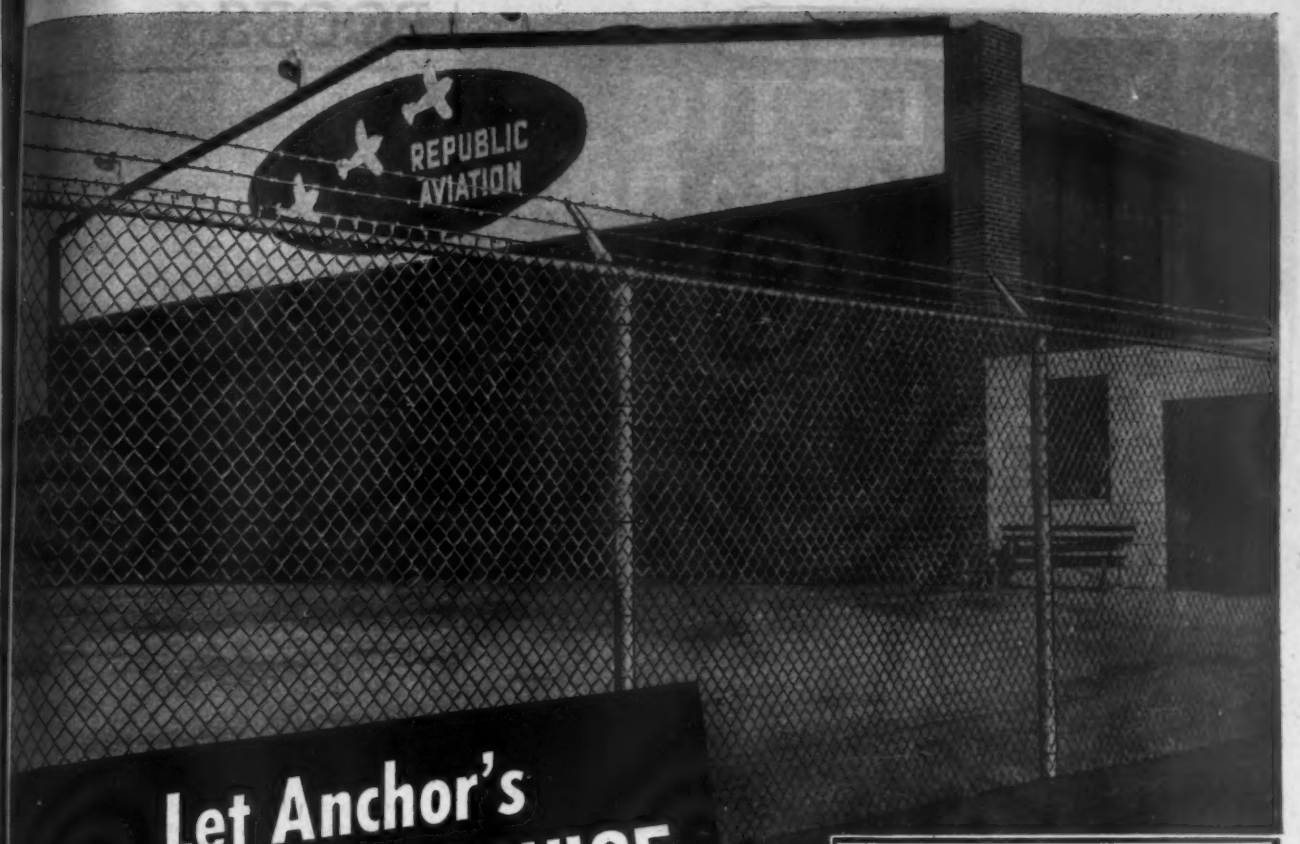

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TODAY your industrial fencing problems are complicated by wartime restrictions—so get the benefit of Anchor's special wartime service! Although restrictions make it impossible for you to obtain standard Anchor Fence (illustrated above) unless your problem deserves special government consideration, acceptable substitutes, shown at right, are still available under the usual priority regulations—and you can count on expert Anchor Fence Engineers to find a practical answer to your needs.

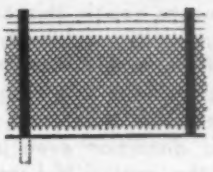
Experienced erecting crews operating out of Anchor's 16 branch offices can erect any of the fences pictured, quickly and efficiently. If you require some other type of barrier, such as a board fence or concrete wall, Anchor men can erect it quicker and better. If you want your present fence moved to a new location, or if it needs realigning, repairing, or painting, call in our experienced men. Our nationwide organization means fast service.

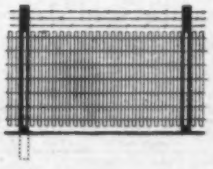
Consult the classified section of your telephone book or write for address of nearest Anchor representative. No obligation. You'll find that Anchor's specialized knowledge can save you time, money, and headaches on any fencing problem. Anchor Post Fence Company, 6620 Eastern Avenue, Baltimore-24, Maryland.

ANCHOR FENCE

Anchor Makes, Erects, Moves, Repairs Every Type of Fence!

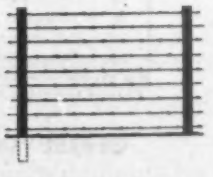
-1- *Chain Link and Barbed Wire on Wood Posts*





-2- *Woven Wood and Barbed Wire on Wood Posts*

-3- *Barbed Wire on Wood Posts*



Anchor Also Makes:

Chain Link Fences
Woven Wood Fences
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Indoor Factory Enclosures
Safety Screening Devices
Factory Window Screening
Factory Partitions

ON ANY FENCING PROBLEM CALL ANCHOR

Castolin Eutectic

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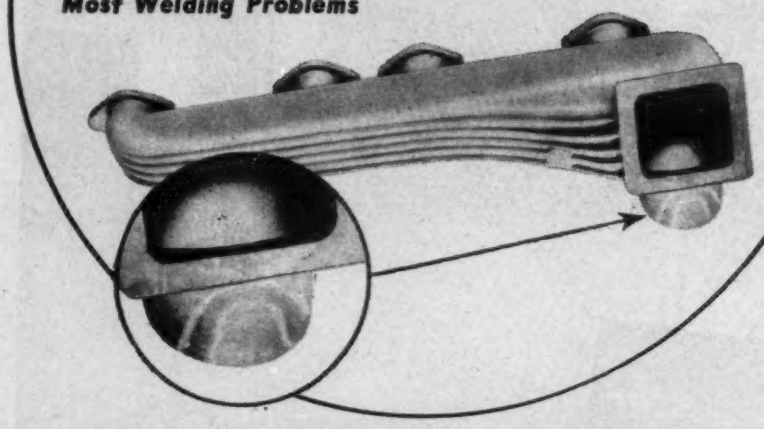
LOW TEMPERATURE
WELDING

. . . The Answer to
Most Welding Problems



NO GENERAL PREHEATING
REQUIRED FOR
WELDING CAST IRON

PROBLEM

How to repair this cast iron exhaust with a color matching, heat resistant weld? With high temperature, fusion welding there was great risk of stresses, new cracks, and distortion even in the hands of the most skillful welder. Bronze brazing could not be used since the job requires a perfect color match.

SOLUTION

Eutectic Low Temperature Welding Alloy No. 14 was tried. Its low binding temperature (950-1400°F) eliminated risk of stresses, new cracks, and distortion. Many jobs require only slight local preheat • Weld has high heat resistance • Easily machinable • Perfectly color matching.

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Alloy No.	Purpose	Binds at °F.	Tensile Strength, Lbs. p.s.i.	Machinable
15	Filling cracks, defects	354° - 600°	1,140 (pressure)	Yes
14	High strength joining	950° - 1400°	48,000	Yes
16	Joining cast iron to steel	1300° - 1600°	117,000	Yes
248	Cast iron not subject to stresses		38,500	Yes
24	Cast iron subject to stresses		20-30,000	Yes

For oxy-acetylene: Eutectic Nos. 14, 15, 16. For AC-DC Metallic Arc: Eutectic Nos. 24, 248.
Chart of 43 Eutectic Alloys for every metal and every welding job available free upon request.

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WELDING ALLOYS COMPANY
Originators of the Low Temperature Welding Process
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BOOKS

APPLIED SAFETY ENGINEERING

H. E. Berman, Safety Engineer, Consolidated Gas Electric Light & Power Co. of Baltimore, and H. W. McCrone, Field Engineer, Baltimore Safety Council. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 189 pages. Forms, index. $2.

Book deals with accidents and near accidents as cases. Each case is analyzed and carried through various successive steps to discover the corrective measures needed to prevent recurrence of similar accidents. Includes chapters on how to make investigations, investigation reports, how to write safety rules and regulations, how to write safety messages, how to hold safety conferences, how to make safety inspections.

THE AMERICAN STORY OF INDUSTRIAL AND LABOR RELATIONS

New York State Joint Legislative Committee on Industrial and Labor Conditions, 12 E. 41st St., New York. 315 pages. Photographs, drawings, charts, index. Trade edition, $1.50; school edition, $1.

Brief review of the way American economy has developed, including the historical evolution of economic, social, and political ideas within the framework of the changing technological conditions under which Americans have earned their livelihood. In three parts—"Changing Times," "The Rules of the Game," "Industrial and Labor Relations in Crisis—War and Post-War Problems."

TECHNOLOGY AND LIVELIHOOD

Mary L. Fledderus, Research Associate, and Mary Van Kleeck, Director, Department of Industrial Studies, Russell Sage Foundation. Russell Sage Foundation, 130 E. 22nd St., New York 10. 237 pages. $1.25.

Analyzes changes in labor requirements and employment opportunities growing out of technological developments in the mineral industries, agriculture, construction, transportation, and communication, and in manufacturing.

TIME STUDY ENGINEERING

William H. Schutt, President, Detroit Time Study School, Inc. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 426 pages. Photographs, drawings, tables, index. $5.

For use as a classroom textbook and as a handbook for time study engineers. Can also be used to tell the working man in the shop how time studies are made and figured, and why they are used. Shop production methods, machinery, and tools are explained, as well as the step-by-step study that should be taken on particular operations. Twenty-three time study charts are included in a pocket inside the back cover. "Questionnaire" at end of each chapter helps reader to check his grasp of material covered in that chapter.

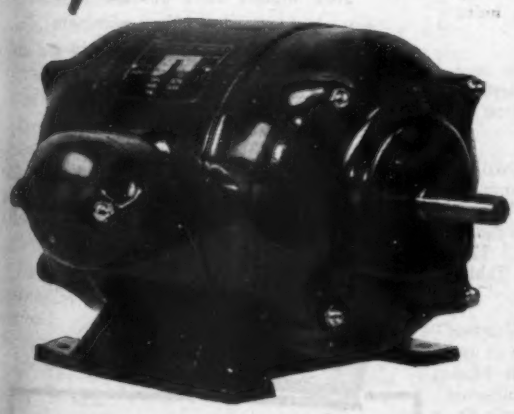
SEVEN STEPS TOWARD SIMPLIFIED OFFICE PROCEDURE

A. H. Stricker, Management Consultant to the House Civil Service Investigating Committee, Washington, D. C. McGraw-Hill Book Co., 330 W. 42nd St., New York 18. 150 pages. $1.75.

Story of the evolving, perfecting, and installing of new office procedures so that paper-

"You'll sleep like a log"

Horsepower by Howell



The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined — utilizing non-breakable steel frame — malleable or steel base — cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

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HORSE: Super., I've got a suggestion — a hot tip —

SUPERINTENDENT: Come, come, be brief. I'm tired!

HORSE: Well, well, that's too bad. But Horsepower by Howell would put an end to all those electric motor problems in your plant. All Howell specialized motors and standard motors are engineered and precision-built for the *hard* jobs. Your jobs will be easy for these quality motors.

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Just as important, note that crisp, clean tread the entire length of cross bar—a feature you can get only with BATES Hex Cross Bar construction.

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work could keep pace with production. Chapter headings include "Gathering the Tools," "Improving the Tools," "Creating a Background," "Devising a Plan," "Establishing Requirements," "Assembling the Data," "Permanence of Files," "Arranging Office Facilities," "Surveying the Job," "Measuring Work and Time," "Assigning the Work," "Determining Time Standards," "Adopting the Plan."

HAND TOOLS

Albert M. Wagener, M.E., Instructor, Shop Theory, Henry Ford Trade School, and Harlan R. Arthur, B.S., Supervisor of Instruction for Naval Training School, Dearborn, Mich. D. Van Nostrand Co., 250 Fourth Ave., New York. 174 pages. Photographs, drawings, index. $1.75.

Prepared as a guidebook to shop tools for the new worker and for the older worker who has been upgraded. No attempt is made to instruct in the use of the tools; the book is concerned rather with identifying the quantities of small tools that are used in every factory and shop. A few lines of explanation, a sketch, and the name are given for each tool to distinguish it from others that are similar in function and appearance.

HANDLING PERSONALITY ADJUSTMENT IN INDUSTRY

Robert N. McMurray, Associate Professor of Psychology and Personnel Administration, Central YMCA College, Chicago. Harper & Bros., 49 E. 33rd St., New York. 297 pages. Index. $3.

Designed to give employers insight into the sources and possible solutions for some of their more pressing problems of personnel administration and industrial relations, attempting to analyze these situations in the light of recent findings of psychology and psychiatry, and work out practical techniques for dealing with them. In four parts—"Labor Problems," "The 'Problem Employee'," "Selection Problems," "Training Problems."

BOOKLETS

YOUR INCOME TAX. J. K. Lasser, CPA. Simon & Schuster, 1230 Sixth Ave., New York. 1944 edition. 152 pages. Forms, tables, index. $1.

POST-WAR REEMPLOYMENT. The magnitude of the problem. Karl T. Schlotterbeck. The Brookings Institution, Washington 6, D. C. 27 pages. Tables. 25¢.

MAINTENANCE OF UNION MEMBERSHIP. A study of official cases and company experience. Bryce M. Stewart and Walter J. Couper. Industrial Relations Monograph No. 8. Industrial Relations Counselors, Inc., 1270 Sixth Ave., New York 20. 83 pages. Tables, appendixes. $1.25.

ALL-OUT WAR PRODUCTION, Weapons for the Production Front. Proceedings of the Second and Third Southern California Management Conferences. Southern California Management Council, 1201 E. California St., Pasadena, Calif. 104 pages. $1.

METHODS FOR SOLVING MANPOWER PROBLEMS. Personnel Series No. 71. Lawrence A. Appley, Anna M. Rosenberg, War Manpower Commission; M. B. Folsom, Eastman Kodak Co.; Henry P. Blumenauer, Albany Castings Co.; Rob Roy Macleod, The Niagara Falls Power Co.; Maj. Gen. Lewis B. Hershey,

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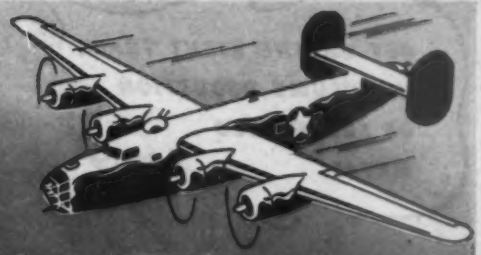

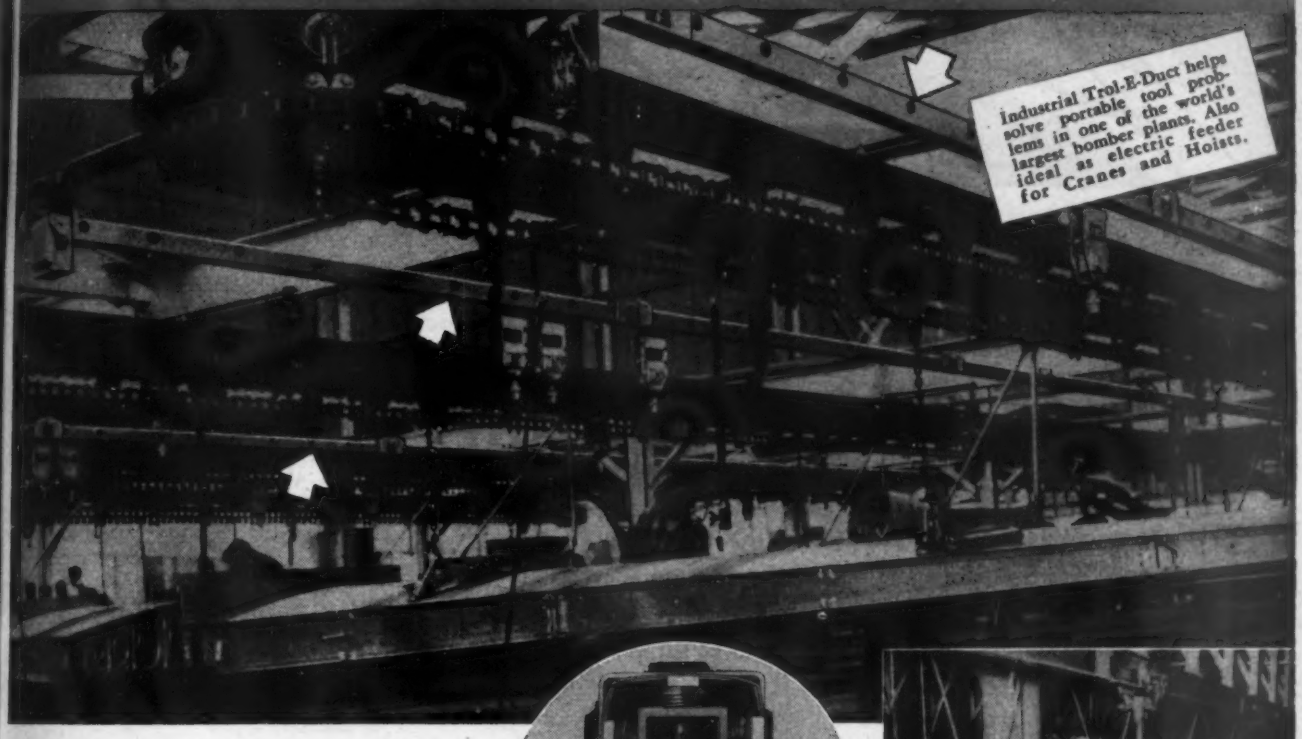

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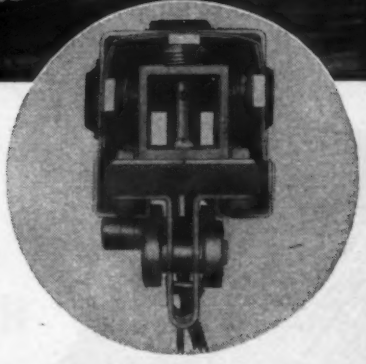
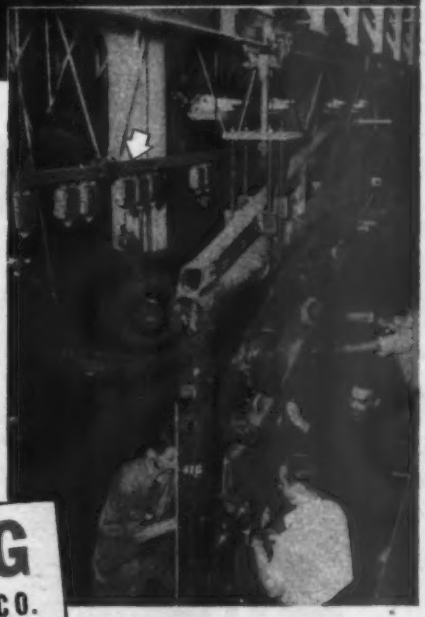


BullDog's new "T" type sliding disc trolley conserves critical material without any sacrifice of operating effectiveness.



How power follows the tools in another big war plant building wings for combat planes.

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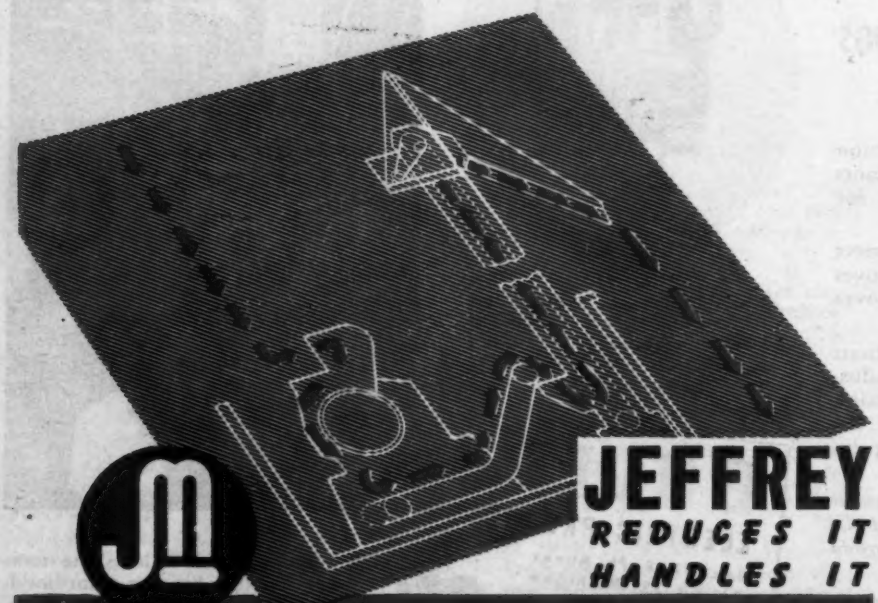

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Selective Service System. American Management Association, 330 W. 42nd St., New York 18. 35 pages. 50¢.

HOW TO TRAIN WORKERS QUICKLY. A manual for training men and women in wartime. Glenn Gardiner. Elliott Service Co., 219 E. 44th St., New York. 62 pages. Cartoons, forms. 45c.

POLITICAL PRIMER FOR ALL AMERICANS. Congress of Industrial Organizations, 718 Jackson Place, N. W., Washington 6, D. C. 16 pages. Drawings. Single copy, 5¢; 100 copies, $3.50; 500, $13.

PERSONNEL ORGANIZATION and Professional Development. Personnel Series No. 74. John A. Stephens, U. S. Steel Corp. of Delaware; Howard M. Dirks, The Perfect Circle Co.; Forrest H. Kirkpatrick, Radio Corp. of America; Samuel L. H. Burk, Triumph Explosives, Inc. American Management Association, 330 W. 42nd St., New York 18. 47 pages. 75¢.

WHEN I GET OUT, WILL I FIND A JOB? Maxwell S. Stewart. Public Affairs Pamphlet No. 86. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20. 31 pages. 10¢.

STREAMLINING THE FOREMAN'S JOB. Personnel Series No. 73. Guy B. Arthur, Jr., The American Thread Co.; Richard C. Oberdahn, American Cyanamid Co.; John A. Mollers, Training Within Industry. American Management Association, 330 W. 42nd St., New York 18. 23 pages. 50¢.

HEALTH EDUCATION ON THE INDUSTRIAL FRONT. The 1942 Health Education Conference of the New York Academy of Medicine. Columbia University Press, Morningside Heights, New York. 63 pages. $1.25.

MAINTENANCE ARC WELDING. The James F. Lincoln Arc Welding Foundation, Cleveland. 234 Pages. Photographs, drawings, tables, charts, index. 50¢ in the United States; 75¢ elsewhere.

TOWARD A NATIONAL LABOR POLICY. With a section on current collective bargaining problems. Personnel Series No. 72. Almon E. Roth, Van A. Bittner, and Lloyd K. Garrison, National War Labor Board; Elmo Roper, "Fortune's" Poll. American Management Association, 330 W. 42nd St., New York 18. 40 pages. 50¢

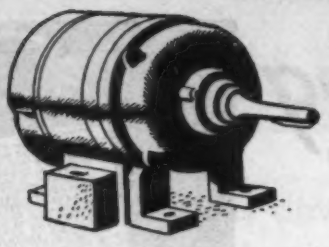
RENEGOTIATION OF WAR CONTRACTS. Accounting Research Bulletin No. 21, supplementing Bulletin No. 15 (September). Committee on Accounting Procedure of the American Institute of Accountants, 13 East 41st St., New York 17. 6 pages. 10¢.

PUBLIC THINKING ON POST-WAR PROBLEMS. Planning Pamphlet No. 23. Jerome S. Bruner, Associate Director Office of Public Opinion Research, Princeton University. National Planning Association, 800 21st St., N. W., Washington 6, D. C. 36 pages. 25¢.

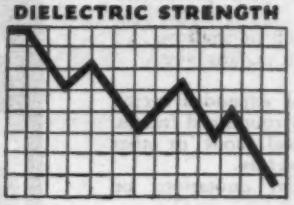
NATIONAL WAGE POLICIES AND PROBLEMS. Personnel Series No. 70. George W. Taylor, National War Labor Board; H. C. Jackson, The Corbin Screw Co.; Hubert F. Teitman, Davis, Polk, Wardell, Sunderland, & Kiendl; Robert Abelow, Theodore W. Kheel, Paul F. Brissenden, Second Region, National War Labor Board. American Management Association, 330 W. 42nd St., New York 18. 63 pages. 75¢.

MANUAL FOR ON-THE-JOB INSTRUCTION of Screw Machine Personnel. National Screw Machine Products Assn., 13210 Shaker Square, Cleveland 20. 107 pages, plus a number

1. ***Moisture can play hob around electrical equipment.***



2. ***It can be absorbed into the insulation and lower its dielectric strength.***



3. ***It can eventually result in all sorts of maintenance misery, as every engineer too well knows.***

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A COMPLETE LINE—heavy and light—or baskets specially-made for *your production needs!*

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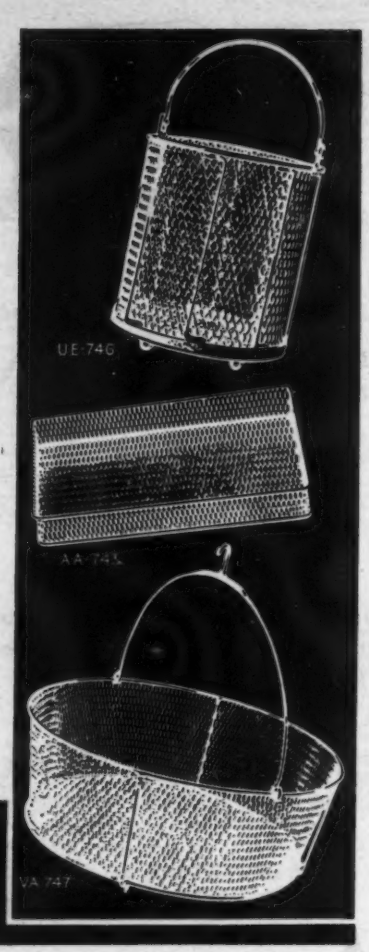

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MANAGEMENT'S POST-WAR PROBLEMS. Eric Johnston, U. S. Chamber of Commerce; Paul G. Hoffman, Committee for Economic Development. Personnel Series No. 69. American Management Assn., 330 W. 42nd St., New York. 19 pages. 50c.

HEALTH AND LIQUIDS. American Bottlers of Carbonated Beverages. 1128 Sixteenth St., N. W., Washington, D. C. 7 pages, file holder size. Bibliography. No charge.

SYSTEMATIC WAGE ADMINISTRATION in the Southern California Aircraft Industry. Robert D. Gray, Professor of Economics and Industrial Relations, Director, Industrial Relations Section, California Institute of Technology. Industrial Relations Monograph No. 7. Industrial Relations Counselors, 1270 Sixth Ave., New York 20. 90 pages. Tables, charts, forms. $1.25.

•

ON THE CALENDAR

FEBRUARY

9–11, American Management Association, Personnel Conference, Palmer House, Chicago. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

MARCH

26–28, American Society of Tool Engineers, Annual Meeting, Bellevue-Stratford Hotel, Philadelphia. Adrian L. Potter, Executive Secretary, 2567 West Grand Blvd., Detroit.

28–30, Safety Engineers, Annual Convention, Hotel Pennsylvania, New York. Paul F. Stricker, Executive Vice-President, Greater New York Safety Council, Lincoln Building, 60 East 42nd St., New York.

28–31, American Management Association, Packaging Conference, Palmer House, Chicago. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

APRIL

3–5, American Society of Mechanical Engineers, Spring Meeting, Hotel Tutwyler, Birmingham, Ala. Ernest Hartford, Executive Assistant Secretary, 29 West 39th St., New York.

3–7, American Chemical Society, Spring Meeting, Hotel Statler and Hotel Cleveland, Cleveland. Alden H. Emery, Assistant Secretary, 1155 Sixteenth St., N. W., Washington, D. C.

13–14, Midwest Power Conference, Palmer House, Chicago. Stanton E. Winston, Conference Director, Illinois Institute of Technology, 3300 Federal St., Chicago.

19–20, American Management Association, Production Conference, Hotel Drake, Chicago. James O. Rice, Manager, 330 West 42nd St., New York.

24–28, National Electrical Manufacturers Association, Spring Meeting, Palmer House, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

25–27, Chamber of Commerce of the United States, 32nd Annual Meeting, New York. Ralph Bradford, General Manager, 1615-H St., N. W., Washington, D. C.

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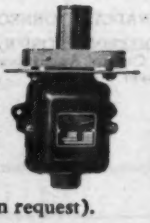

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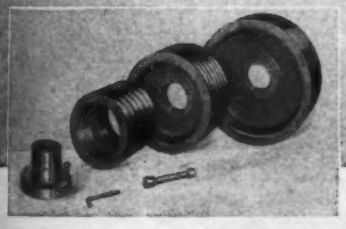

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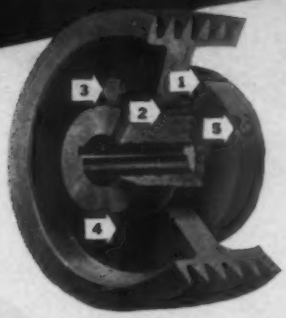

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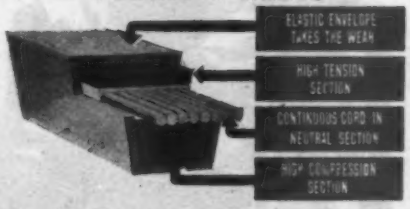

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–4–

BELTS—A 70-page handbook gives V-belt and flat-belt drive selection tables, specifications, and installation instructions. It shows how to increase machine production through eliminating belt slip, and how to increase belt and bearing life. American Pulley Co.

–5–

CASTERS—Steel forged casters are the subject of 40-page Catalog 65-1C. Construction features, how to select and mount casters, and selecting the correct wheel bearing, are discussed. Available models are pictured, with typical uses and load capacities given. The Rapid Standards Co.

–6–

CHAIN BELT DRIVES—Information on maintenance, lubrication, and repair of chain belt drives is given in a 20-page booklet. Purpose of the publication is to help users save delays and expense. Chain Belt Co.

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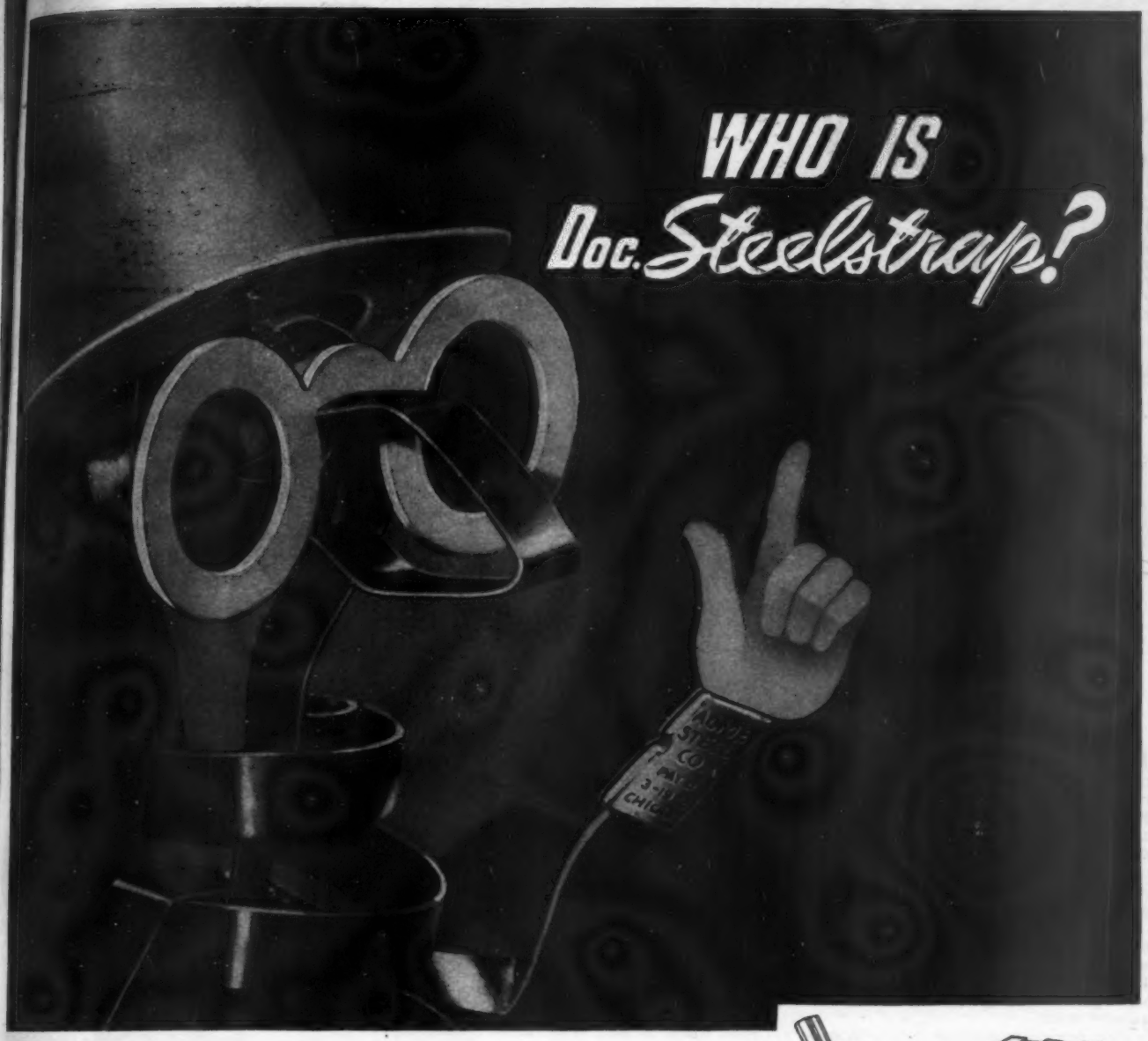

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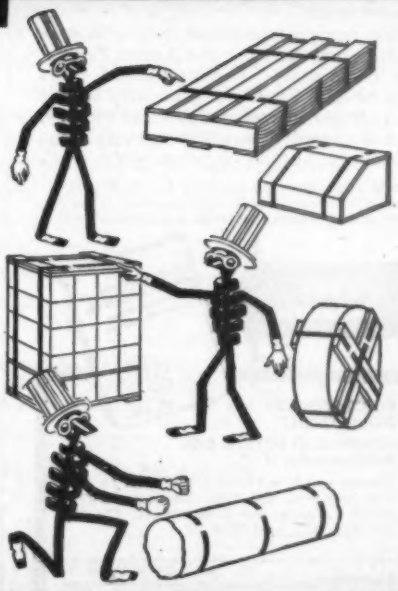

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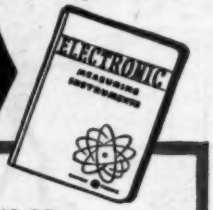

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CRANES—The uses of cranes, tramrails, and steelwelds are pictured and described in a bulletin. Capacities, spans, speeds, and construction details of the cranes are given. Photographs show them at work. The Cleveland Crane & Engineering Co.

–9–

CRAYONS—Chalks and crayons with industrial uses as markers for carpenters, railroadmen, inspectors, trimmers, and draftsmen are included in a 14-page catalog. The various requirements met by each marker are specified. The American Crayon Co.

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ELEVATORS—Types and applications of portable elevators used in the scientific piling and stacking of material for storage are illustrated in circular. A wide variety of platform types is included. The Revolvator Co.

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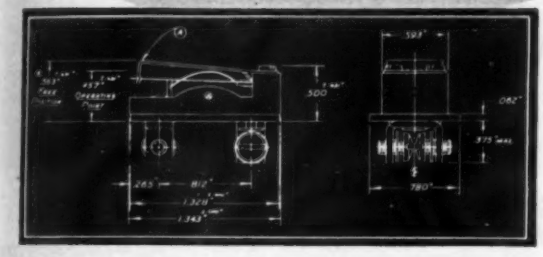

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–16–

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–17–

FLOW METERS—Booklet of 16 pages tells why, when, and where flow meters and instruments are needed in the modern plant. Metering data are covered, arranged in two facing pages for convenient use. Drawings show installation methods. Cochrane Corp.

–18–

GOGGLES—The quickest, easiest methods of adjusting non-prescription industrial safety goggles are explained in illustrated booklet. Objective is to help prevent eye accidents caused by workers refusing to wear improperly fitted goggles because of discomfort. American Optical Co

–19–

GUARD—for power press protection is presented in leaflet treating press maintenance, feeding methods, inspection, and supervision. Operating principles and construction of four classes of guards are explained. Junkin Safety Appliance Co.

–20–

HEATING—ventilating, and air conditioning units and their applications are treated in a 10-page bulletin, including such products as air diffusers, bake ovens, hot water generators, and heat baffles. Diagrams show construction features. Air Devices, Inc.

–21–

HOLE PUNCHING—A line of hole punching units and accessories is presented in a 28-page catalog. Specifications, set-up methods, and prices are included. Illustrations are in four colors—matching colors show which units may be used in the same press brake at the same time. Wales-Strippit Corp.

–22–

HYDRAULIC PRESSURE GENERATORS—controls, valves, hydraulic power units, gear pumps, cylinder and ram assemblies are described in 4-page folder. Construction features of complete line are explained and illustrated. Hydro-power Systems.

–23–

INFRA-RED—The history of infra-red radiant heating and its applications in drying

If you can't get BRASS or BRONZE!

Switch to Permanent Mold Iron Castings Made by the Eaton Permanent Mold Process!

If you are finding it increasingly difficult to obtain Brass Castings or Bronze Forgings, a conversion to Permanent Mold Iron Castings produced by the Eaton Permanent Mold Process may be your answer—for these four big reasons:

1. **PERMANENT MOLD IRON has a fine-grained homogeneous structure—a factor that makes it absolutely free of porosity.**

2. **PERMANENT MOLD IRON compares favorably with Brass and Bronze in machinability, can be worked with little change in present machine tool setup.**

3. **PERMANENT MOLD IRON is a lower base cost material.**

4. **PERMANENT MOLD IRON CASTINGS can be produced in complex, cored designs or simple shapes with accuracy and uniformity, by this patented EATON PERMANENT MOLD PROCESS.**

In numerous conversion applications over the past ten years, Permanent Mold Iron Castings—made on our battery of rotating, 12-head, semi-automatic, volume-producing machines—have successfully met Industry requirements. Let us give you the whole *convincing* story.

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EATON MANUFACTURING COMPANY

Foundry Division

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Put it On, Let it Dry, Rub it Off

...It's That Easy!

WHITE Metal Polish for lighter colored metals—BROWN for copper and brass! Two excellent polishes—each made to do a specific job and do it well.

Both products dissolve tarnish chemically so that a soft cloth wipes it away without rubbing. Brilliance is restored and a protective coating is deposited that retards oxidation. Because tarnishing is retarded, less frequent cleanings are needed, time and cost are saved. *Write Industrial Division, R. M. Hollingshead Corp., Camden, N. J., for name of nearest distributor.*

Powdered and Liquid Hand Soaps · Scrubbing Soaps · Cleaners · Floor Waxes · Odorless and Concentrated Insecticides · Furniture and Metal Polishes · Drain Pipe and Bowl Cleaner · Protective Hand Cream · Degreasing Compound · Hydraulic Fluids · Rust Preventives.

Hollingshead

LEADER IN MAINTENANCE PRODUCTS

BUY MORE BONDS

paints, metal control, woodworking, plastics, textiles, rubber, and paper industries are treated in a 28-page booklet. Future uses of radiant heating are also reviewed. Companion booklet gives diagrams and specifications of infra-red heating equipment. C. M. Hall Lamp Co.

–24–

INSULATION—"Insidline," developed to enable ordinary carbon steel pipe, with its comparatively light-weight and low cost, to stand up under pressure at temperatures above 1000 degrees, is treated in a booklet on internal insulation. Baldwin-Hill Co.

–25–

JACKS—A line of airplane wing jacks, including mechanical jacks for every requirement in landing gear, strut, and undercarriage repair is treated in an 8-page bulletin. The Duff-Norton Mfg. Co.

–26–

LIGHTING—"Design for Efficient Industrial Seeing," a 12-page brochure, BL-3, discusses the need for balanced lighting. Sketches show examples of right and wrong applications. Lighting equipment to meet various requirements is illustrated and described. The Fostoria Pressed Steel Corp.

–27–

LIGHTING—A series of commercial fluorescent units for office and drafting rooms available on AIJ priorities or higher is contained in 4-page folder No. 11-43. Illustration, features, and specifications of four units meeting WPB weight limitations are included. F. W. Wakefield Brass Co.

–28–

MAP—28x36 3/4-in. colored transportation and industrial map of the Cincinnati Commercial Area shows railroads, main highways, airports, political subdivisions, and industrial sites. Cincinnati Chamber of Commerce.

–29–

METALLIZING PRODUCTS—Catalog 42B describes guns, wires, surface preparing tools, and other metallizing accessories in detail. In addition, it tells how sprayed metal coatings are saving critical materials in the production and maintenance of parts and equipment. Metallizing Engineering Co.

–30–

PACKAGING—A 14-page bulletin describes standardized load center unit substations of 100 to 2000 kva. capacity. A nomogram for selecting the correct air circuit breaker is featured. Allis-Chalmers.

–31–

PACKING MATERIALS—Fibrated leather packing, low-cost gasket material for general use, and a non-corrosive gasket material are

Speed Sweep

WITH A BACK OF STEEL

MAKES LIGHT WORK OUT OF TOUGH JOBS

Steel back of Speed Sweep brushes is the basis of unique construction for faster, easier, better sweeping. Block is ⅓ usual size – easier to handle. Tufts of longer, better fibres are more compact – provide "spring and snap" action. Handle instantly adjustable to height of sweeper, reduces fatigue and strain. Speed Sweep brushes are built to outlast ordinary brushes 3 to 1.

Heavy Duty *Speed Sweep* Brushes

of heavy Bassine fibre for rough work through grease, cutting oils, metal filings, etc.

Catalog No. and Size	PRICES Lots of: 1	6	12	24
No. 411—14"	$2.80	$2.35	$1.95	$1.75
No. 413—18"	3.00	2.60	2.20	2.00
No. 416—24"	3.55	3.15	2.70	2.50

Double Duty *Speed Sweep* Brushes

have two center rows of heavy Bassine fibre for rough dirt and two outside rows of finer Union fibre to control dust.

Catalog No. and Size	PRICES Lots of: 1	6	12	24
No. 421—14"	$2.95	$2.55	$2.15	$1.95
No. 423—18"	3.35	3.00	2.55	2.35
No. 426—24"	3.85	3.45	3.05	2.80

(All prices F.O.B. Milwaukee—Quantity prices apply on mixed orders.)

FULLY GUARANTEED - ORDER TODAY

Since Pearl Harbor, Speed Sweep brushes have been adopted in thousands of factories. Their superiority has been proved under such varied conditions that they are unconditionally guaranteed to meet your requirements. Order at once for prompt shipment. Extend AA-5 or higher priority rating.

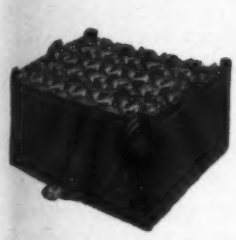
M D

Milwaukee Dustless

BRUSH COMPANY

526 N. 22nd St., Milwaukee 3, Wis.

THESE STORAGE BATTERIES ARE *VETERANS* OF TWO WARS



A Report on Conservation for Users of Industrial Trucks

Omaha Public Library
Reference Dept.

ADVANTAGES OF THE EDISON ALKALINE BATTERY IN INDUSTRIAL TRUCKS AND TRACTORS

★It is durable mechanically. High strength steel construction is used in the containers, grids, pole pieces, etc. The electrolyte is a preservative of steel.

★It is foolproof electrically. It may be accidentally short-circuited, over-charged, over-discharged, or even charged in the reverse direction without injury.

★It can be charged rapidly. It is not subject to finish-rate limitations. It requires no equalizing.

★It withstands temperature extremes. It is not damaged by freezing. Free air spaces on all sides of all cells provide ventilation for rapid cooling under high temperature conditions.

★It is simple to maintain. Merely charge adequately, add pure water, keep clean and dry.

★Its tray assembly and cell connections are extremely simple.

★Its life is so long that its annual depreciation cost is lower than that of any other type of storage battery.

During World War I, a New England plant installed a fleet of battery industrial trucks each provided with two Edison Alkaline Batteries, one to operate the truck while the other was on charge. The trucks worked around the clock on war production, but after the Armistice the plant went to an 8-hour day so that one battery per truck was enough and the spare batteries were not needed. They were put into storage and there most of them remained until the outbreak of the present war.

Now they are again in service. In spite of the fact that most of them stood idle for nearly a quarter of a century, they are doing a completely satisfactory job keeping the trucks supplied with power. In fact, shortly after the outbreak of the present war, the plant purchased a new truck without a battery because its reserve stock of spare batteries was still ample.

The current performance of these veterans of two wars is living testimony to the extra reserve dependability in the Edison Alkaline Battery. Some of the unique characteristics which account for this dependability are cited in the column at the left.

EDISON STORAGE BATTERY DIVISION, THOMAS A. EDISON, INCORPORATED, WEST ORANGE, NEW JERSEY

Edison

ALKALINE BATTERIES

HAS SO FEW MOVING PARTS

The use of worm gear speed reduction in Reading Electric Hoists is the reason why there are only four moving parts. This means fewer wearing parts, both gears and bearings and a simpler more compact design. The result is a minimum of maintenance that can be handled by the average mechanic.

It will pay you to investigate the money saving features of Reading Electric Hoists. For full technical information write for Bulletin 1004.

READING CHAIN·HOISTS·ELECTRIC HOISTS OVERHEAD TRAVELING CRANES

READING CHAIN & BLOCK CORPORATION 2103 ADAMS ST., READING, PA.

MB
is Marching
"ON-THE-DOUBLE"!
In the present emergency, practically the entire facilities of the M-B plant are devoted to the war effort. We are working day and night, producing vitally needed war materials to help beat the Axis. At the same time, we are preparing for a peaceful, post-war era which we hope is just around the corner. Already our engineers have made constructive plans for the further improvement of M-B civilian equipment — Trailers... Winches... Street and Road Markers... Industrial Markers... Centrifugal Pumps. For literature write: MEILI-BLUMBERG CORP. • New Holstein, Wis., U. S. A.
MEILI-BLUMBERG
Manufacturers of the Famous M-B Line of INDUSTRIAL EQUIPMENT

treated in a folder giving applications and construction features of each. Samples of the packings are attached. Armstrong Cork Co.

–32–

PIPE BENDING—Methods and devices for bending pipes and tubes of copper and its alloys are shown in 80-page handbook. Included are 113 figures and illustrations as well as 35 full pages of engineering data. Copper & Brass Research Assn.

–33–

PIPE THAWING—Electrical equipment for thawing street mains, fire lines, small pipes, and lead-in pipes is presented in 4-page brochure. Connection diagrams, prices, and other data pertaining to transformers are given. General Electric Co.

–34–

POWER TRANSMISSION – A 32-page booklet stresses the necessity for a planned power transmission program. Practical suggestions for the salvage of belts and pulleys, and hints on the maintenance of other drive components, are given. Charts show the saving of cost and critical materials that can result. Cling Surface Co.

–35–

PROTECTIVE CREAM—Called "the invisible work glove for industry," a cream to protect exposed skin surfaces against industrial dermatitis, is presented in booklet. Both water soluble and waterproof types are discussed. Cadet Creme Co.

–36–

PUMPS—Information concerning the mechanical parts and construction of speed prime pumps is contained in a 20-page catalog. Also included are specifications and capacity charts to aid in pump selection. Chain Belt Co.

–37–

PUMPS—Material for design engineers and others concerned with improved methods of handling liquids and utilizing pump power is presented pictorially in 28-page booklet entitled "Pressured Power and Controlled Flow." Pesco Products Co.

–38–

PYROMETERS—A line of electric thermometers, pyrometers, photo-electrically balanced recorders, indicators, and controllers is presented in Catalog No. 1101H. Specifications and detailed diagrams are given for each unit. C. J. Tagliabue Mfg. Co.

–39–

REPLACEMENT PARTS—For the maintenance of all existing plumbing and heating systems catalogued in 64-page book. Complete equipment for faucet renewal service, tank

Colson

WORTH ITS WEIGHT IN GOLD

JUST a hand truck—but did you ever stop to think just how important a part it plays in the loading of cargo planes, ships and box cars? Yes sir, when it comes to getting ammunition and supplies to our boys who are over there doing a job, trucks such as this one are worth their weight in gold.

Yes, just a hand truck—but doing its bit on the home front, too, where it is used in the movement of thousands of items from raw materials to finished products.

Materials handling equipment is our business and we manufacture hundreds of different types of trucks and casters for the transporting of everything from crates, boxes, and barrels, to delicate laboratory instruments.

Let's All
Back The Attack
BUY MORE
WAR BONDS

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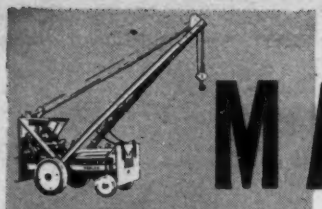
ELYRIA, OHIO

CASTERS • INDUSTRIAL TRUCKS AND PLATFORMS • LIFT JACK SYSTEMS • BICYCLES • CHILDREN'S VEHICLES
WHEEL CHAIRS • WHEEL STRETCHERS • INHALATORS • TRAY TRUCKS • DISH TRUCKS • INSTRUMENT TABLES



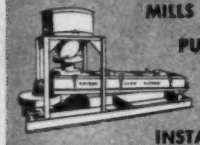
MATERIALS HANDLING & PROCESSING EQUIPMENT

WHEEL TRACTOR CRANES
HOISTING UNITS
TRAILER TRUCKS

LIFT TRUCKS
CONVEYORS
CARTS & TOOL WAGONS
ELEVATORS

GYRO SIFTERS
CRUSHERS

CUTTERS
MILLS & MIXERS



PULVERIZERS
GRINDERS
COMPLETE INSTALLATIONS

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 40 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON COMPANY, INC.
INQUIRIES INVITED
30 CHURCH ST., NEW YORK 7, N. Y.

Beauty is only skin deep, but in the case of the new "Warrior" luminaire, an attractive exterior hides the solid qualities of good design and workmanship that have made the Curtis reputation. "Warrior" is easy to install and is adapted to a wide variety of lighting problems . . . excellent for either pendant or ceiling mounting or for long continuous runs.

Easy to MAINTAIN . . .

The spring catches on each side of the "Warrior" hold the entire louver and end assembly in position. Releasing the two catches on either side permits the entire assembly to swing open for cleaning and lamp replacement. To remove the assembly release all four catches. ***Write for folder for complete information.***

CURTIS *Lighting*, INC.
6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

repair service, and general repair are included. J. A. Sexauer Mfg. Co., Inc.

–40–

ROPE—The 160-page wire rope buyers' guide G-15, contains tables and information on conservation and care of wire rope. A tabbed index, with contents to each section printed on each index, plus a general index, are included. Macwhyte Co.

–41–

STEAM LOCOMOTIVES—Technical data on industrial locomotives, as well as railroad switching locomotives, are given in 68-page catalog. More than 50 locomotive types are illustrated, with complete specifications. Articles are amplified by mechanical drawings and tables. H. K. Porter Co., Inc.

–42–

STEEL—A 30-page Bulletin 1143-C1 treats manganese steel, claimed by manufacturers to be the toughest steel known. Physical properties, breakage, and wear factors are discussed. Products of this metal are pictured and their industrial applications are given. American Brake Shoe Co.

–43–

STEEL CUTTING—Manual GT-166, a vest-pocket guide, covers the characteristics of different grades of carbides designed for steel cutting, selection of proper rake and relief angles, and size of radius. Machine requirements, design and grinding of chip breakers, and operating hints for carbide tools, are also included. Carboloy Co., Inc.

–44–

STEEL PRODUCTS—Circular steel products such as wheels, rollers, flanges, gears, and pinions are the subject of a 40-page booklet. Photographs illustrate the text, and charts present hardness comparison, physical properties, weight factors, and dimension details. Farrell-Cheek Steel Co.

–45–

STEEL PRODUCTS—To celebrate its 75th anniversary, maker of steel lockers and shelving has published 32-page booklet in which the history of the company is traced and interwoven with the significant industrial and political events down through the years. Seven pages are devoted to a list of patents taken out by the founder. Penn Metal Co., Inc.

–46–

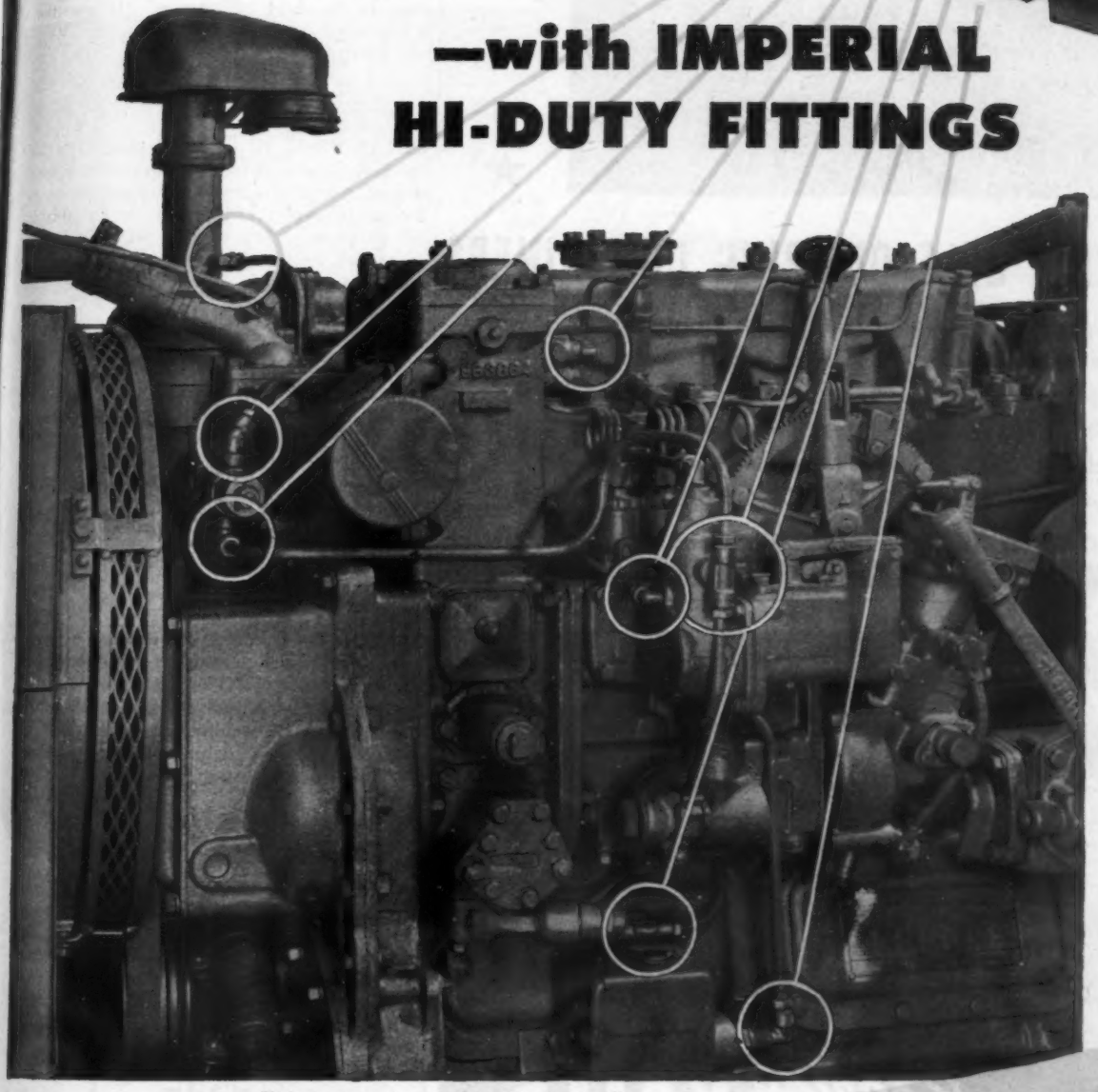
TEMPERATURE CONTROL—Problems of temperature and humidity control encountered in eight industries, and their solutions, are presented in a brochure. Each problem is illustrated. Carrier Corp.

–47–

THREAD GRINDING—A 6-page, two-color instructional bulletin is illustrated to show

VITAL TUBING LINES STAY TIGHT

—with IMPERIAL HI-DUTY FITTINGS



Photograph courtesy of Caterpillar Tractor Co.

★ A well-known tractor manufacturer sought a tube fitting that would simplify assembly of tubing lines, assure tight joints and eliminate vibration breakage in the field.

After careful study and tests, Imperial Hi-Duty Fittings were selected. Hi-Duty Fittings are 2-piece fittings, speedily installed, and under extreme vibration tests have stood up an average of 8 times as long as ordinary compression or flare fittings.

Hi-Duty is just one of many fitting types offered by Imperial. On your tubing connection problems, Imperial's broad experience can often be of assistance.

Bulletin 3101 covers several Imperial Fittings, including Hi-Duty. Write for your copy.

THE IMPERIAL BRASS MFG. COMPANY
517 South Racine Avenue, Chicago 7, Illinois

IMPERIAL

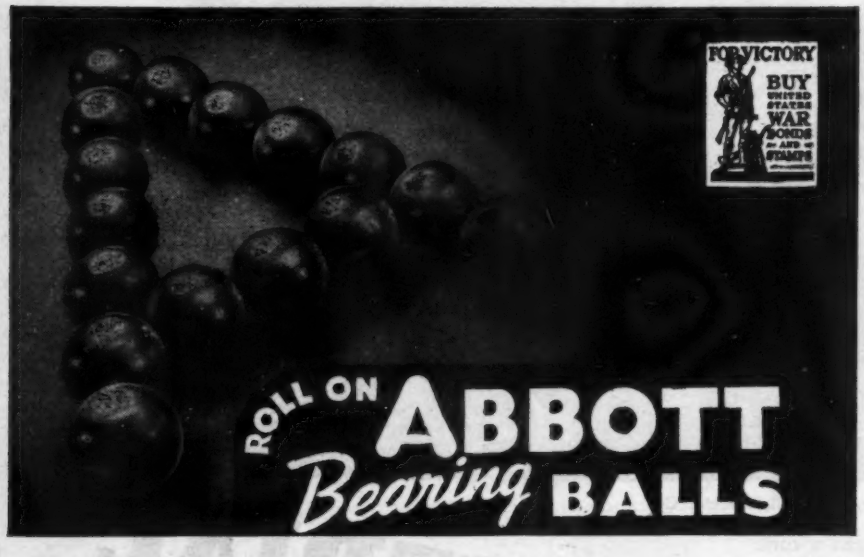
★ *headquarters for tube fittings*

COMPRESSION, S.A.E. FLARE, INVERTED FLARE, HI-DUTY, FLEX AND FN FITTINGS FOR COPPER, BRASS, STEEL, ALUMINUM AND FLEXIBLE TUBING • SHUT-OFF COCKS • NEEDLE VALVES • FUEL STRAINERS • TUBE WORKING TOOLS

INDUSTRIAL SELF-DUMPING CONTAINERS

The present high cost of labor makes it expensive to unload ordinary transfer bins or containers. These self-dumping, stock containers will unload themselves. Built to fit any standard lift truck. They are heavily constructed, practically designed and they have been used for over twenty years. WRITE FOR CIRCULAR.

ROURA IRON WORKS, 1405 Woodland, Detroit, Mich.



UNINTERRUPTED PERFORMANCE

SPECIFY "ABBOTT" — When you use ABBOTT BEARING BALLS you are assured of uninterrupted performance whether the application is a light, intricate mechanism or a heavy duty assembly. ABBOTT will carry the load as planned.

Estimates of Delivery gladly given

ROLL ON **ABBOTT** *Bearing* **BALLS**

THE ABBOTT BALL COMPANY HARTFORD, CONN. U.S.A.

typical thread-grinding operations, wheel dressing, and six steps required to mount a grinder. Helical angle tables for two types of threads are shown. The Dumore Co.

–48–

TURBOSUPERCHARGER—A 32-page bulletin, fully illustrated, reviews the development of the turbosupercharger, describes its construction, points out how it differs from the geared supercharger, and lists its advantages in the field of aviation. Its operation is explained in non-technical language. General Electric Co.

–49–

ULTRA-VIOLET RAYS—Equipment that has been produced for the ultra-violet irradiation of groups of persons is the subject of an 8-page brochure. Claimed to be a valuable aid to workers' health, the circular lamp is offered as a scientific method to prevent absenteeism. Hanovia Chemical & Mfg. Co.

–50–

UNIVERSAL JOINT—Bulletin CS-10 describes precision cut, manganese bronze, bevel gear universal joint with angular range of 0 to 135 degrees on vertical center line or 0 to 360 degrees on horizontal center line. Data on brackets and shaft hangers also given. Condenser Service & Engineering Co.

–51–

WELDING—Problems in welding reclamation, salvage, and production are discussed in the first issue of "The Eutectic Welder," 4-page paper to be published monthly. New developments in welding design, metallurgy, methods, and cost analysis will be announced in forthcoming issues. Eutectic Welding Alloys Co.

–52–

WELD INSPECTION—A two-color, 23x35-in. chart pictures actual specimens of various results obtained in making fillet and butt welds and describes the appearance and characteristics of proper and improper weld beads, with conditions under which each was made. The Lincoln Electric Co.

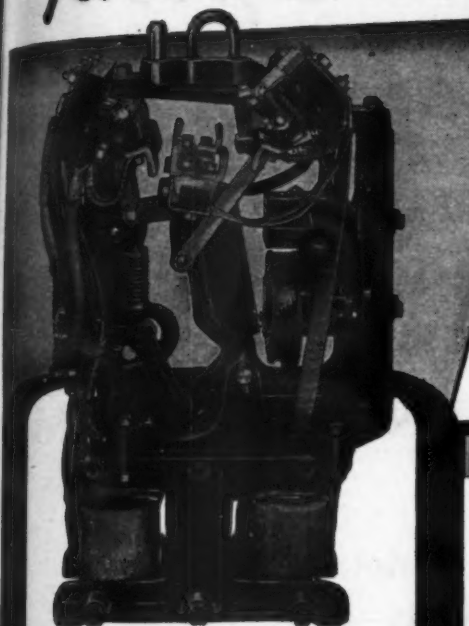
–53–

WELDING—Photographs of oxyacetylene processes and electric arc welding being used in production, repair, and maintenance work are contained in a 16-page booklet. Building progress of a C-3 ship is followed from keel laying to launching. Air Reduction.

–54–

WELDING DATA—Book of 36 pages contains facts on low temperature welding for fabrication, salvaging, and general maintenance. Hints on how to increase welding efficiency, and a special chart devised to simplify rod selection and use are included. Eutectic Welding Alloys Co.

EC&M REDUCED VOLTAGE STARTERS for 110-550 Volt MOTORS



COMPENSATOR MECHANISM

Single, quick-break, double-throw Contactor operated by a *single* magnet. Quick transfer from reduced voltage starting to full voltage running by a throw-over spring and a mechanical latch tripped by a current limit relay.

Bulletin 1045-A

Complete unit with conduit-connection box at rear and overload relays under cover-hood.

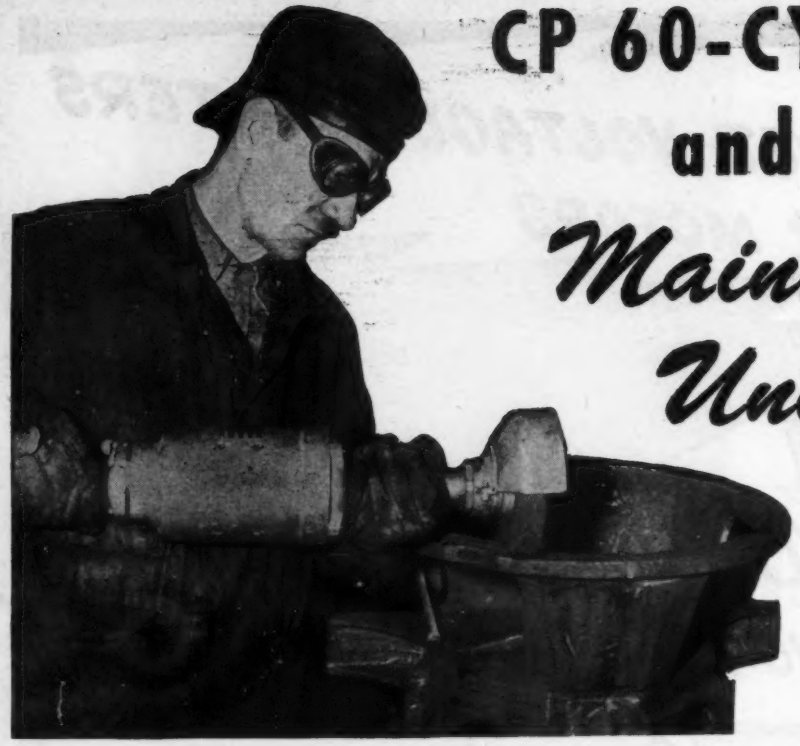
PUSH BUTTON OPERATED

HERE'S a starter that is very popular with operating and maintenance men. It is not an adaptation of contactor-equipment, but a simple, completely wired unit, totally enclosed and oil-immersed in a steel tank.

Total oil-immersion of the compensator-mechanism not only permits interrupting the circuit under oil (recognized as an effective means for breaking alternating currents) but also provides continuous lubrication for all operating parts of the mechanism and protects them from dust, moisture and corrosion.

In over 1000 plants, these EC&M starters have provided fool-proof, dependable operation for a number of years. Bulletin 1045-A completely describes them. Write for your copy today.

THE ELECTRIC CONTROLLER & MFG. CO.
2700 E. 79th St. ★ Cleveland 4, Ohio



CP 60-CYCLE GRINDERS and SANDERS

Maintain Speed Under Load

COMPARE WITH HICYCLE GRINDERS IN EFFICIENCY AND ECONOMY

Ideal for plants whose operations do not warrant the installation of high frequency tools—or plants that have such tools but lack high frequency power lines at points where additional tools could be advantageously used, CP-460 Grinders and Sanders afford fast, uniform grinding and sanding. They have a powerful, efficient, lightweight induction motor of the same type as the well-known CP Hicycle Grinder but operate on 60-cycle, 3-phase, 220-volt A.C. This motor insures high sustained speed under load. Absence of commutators, brushes, brush holders, armatures, etc., assure lower maintenance costs. Write for complete details.

★★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

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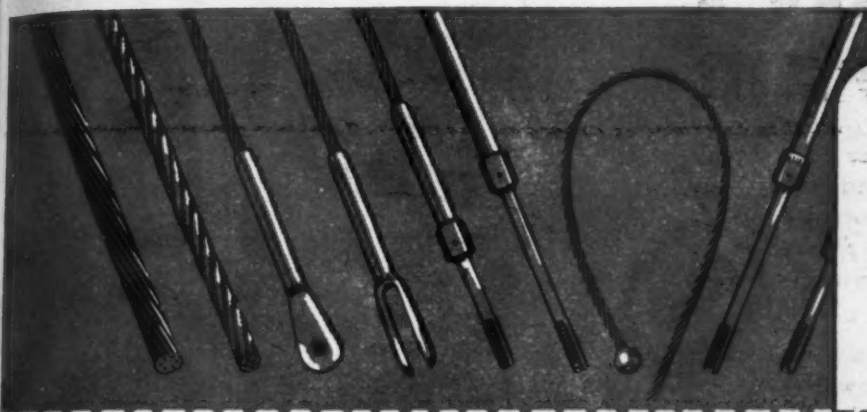
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

TAKE ONE *or all four answers*



THE PROBLEM OF EQUIPMENT CONTROL

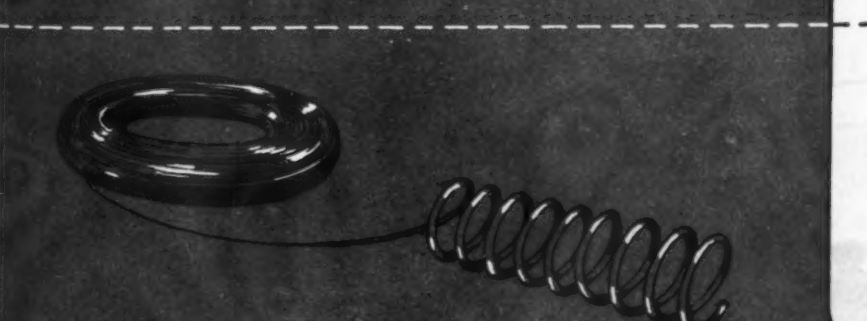
You may learn a lesson from a bomber if you can adapt steel-strong, silky-flexible cord of the type Roebling makes for aircraft controls to your own equipment. It transmits motion accurately, efficiently . . . and it endures. Complete assemblies with swaged terminals available for reasonably prompt delivery.

THE PROBLEM OF EMERGENCY POWER

Here's a safe, easy way to extend electrical distribution circuits—Roebling Parkway Cable laid directly in a shallow trench. Eliminates time and expense of conduits, manholes, poles, etc. for lighting, signal and fire alarm circuits.

THE PROBLEM OF PRODUCT GRADING

Coal mines are swinging to the use of these bound-edge woven-wire screens for accurate grading. Roebling gives them the specialized steel that can take it in any grading operation, and the know-how that weaves and binds them right. Can such screens be tailor-made to *your* use?



THE PROBLEM OF ABSORBING SHOCK

Many a coil spring gets its start from a roll of Roebling Tempered and Blued Round Wire, made to hit "specs" on the nose for dimensions, steel analysis, temper and finish. This division also makes flat and shaped wires, strip steel . . .

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TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

PACEMAKER IN WIRE PRODUCTS

Wire Rope and Strand • Fittings • Electrical Wires and Cables
High and Low Carbon Acid and Basic Open Hearth Steels
Wire Cloth and Netting • Aerial Wire Rope Systems
Suspension Bridges and Cables • Round and Shaped Wire
Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies

MOBILIFT
Takes to the AIR

A whole new industry is being born. Today because of our far-flung fighting fronts, precious supplies are being transported by cargo planes. Tomorrow these same planes will be used for developing a world-wide system of air freight transportation.

And this new transportation field will require a warehousing system all its own — a system where Mobilift fits into perfection. Unit loads .. lighter freight packages .. faster handling methods and the varying heights of plane floors all demand the qualities which have made Mobilift the favorite of both military and industrial transportation. Keep Mobilift in mind when planning future warehousing.

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MOBILIFT *Moves Materials like a Giant!*

VAUGHAN MOTOR COMPANY ★ 835 S. E. Main Street, Portland 14, Oregon

LUBRICATE ALL BEARINGS FROM A CENTRAL SOURCE!

LINCOLN CENTRO-MATIC LUBRICATING SYSTEM

is easily installed... no machinery alterations necessary

SAVE man-power... Save man-hours... Avoid bearing failures... Cut war production delays... Lower your lubrication and maintenance costs by equipping your machines with Lincoln Centro-Matic Centralized Lubricating Systems... Easily installed on new or old machines.

A Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a power operated or a hand operated Centro-Matic Lubricant Pump. A power operated system can be either time clock control (as illustrated) or push button control... The injectors can be grouped in manifold or located separately at each bearing. In either arrangement only a single lubricant supply line is required.

The **ARMY-NAVY PRODUCTION AWARD** for high achievement in the production of war equipment, conferred upon the Lincoln Engineering Company has had two stars added. Each of these stars symbolizes 6 additional months of exacting service to our Armed Forces, delivering vital materials so necessary for ultimate Victory.

Write us today for complete information

143-53

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Lubricating Equipment

5701 NATURAL BRIDGE AVENUE, ST. LOUIS 20, MO., U. S. A.

Home *is where they park their* Huts!

Official Signal Corps Photo

Ed Miller often cussed the cold of winter in his native state and dreamed of living some day in a warmer climate. But that was before the war. Now Ed's Private Miller, "wintering" with the U. S. Army at a frigid outpost in the far, far North. And home is where he parks his hut!

There are countless Ed Millers somewhere "up there" tonight—and not doing so badly, thank you. For those portable barracks Uncle Sam provides for his men in arms are comfortable beyond belief—well heated, well ventilated and well lighted.

Many, many more of these prefabricated steel dwellings may be needed as our offensive spreads to new lands in this vast global war. So, at the Cincinnati Sheet Metal and Roofing Company (one of several producers of corrugated steel panels for such barracks) every effort is aimed at speeding up production. An example of this was the company's installation of a DeVilbiss automatic spray system which saves time in preparing the steel panels for duty at the front. It applies *over 120 gallons* of olive-drab, lusterless enamel per hour!

Today, DeVilbiss Spray Systems are busy everywhere, coating, painting and finishing things quicker that they may join the fight sooner. *Tomorrow,* when *your* plant is freed for the competitive manufacture of the better peacetime products the whole world expects, DeVilbiss Spray Equipment will help you produce them faster—and at lower cost.

THE DEVILBISS COMPANY, TOLEDO 1, OHIO
Canadian Plant: Windsor, Ontario

DE VILBISS
Spray Systems

SPRAY EQUIPMENT • EXHAUST SYSTEMS • AIR COMPRESSORS • HOSE & CONNECTIONS

THIS PRODUCTION GIANT

HAS A "Nerve System" OF PAPER

This "Nerve System" may fail... unless industry saves paper this special way

America's industrial machine is like a huge robot. Powerful in full stride . . . but virtually helpless without *direction* and *control*. It cannot function without a "nerve system" of paper . . . all those control systems and accounting records that *start, stop* and *direct* every operation of industry.

Today, a serious paper shortage threatens this "nerve system." And saving paper by the pound, as waste baskets are emptied, is not enough. This goes mainly into heavy papers and containers, not fine papers used for records. You must save *new* paper by the mile . . . examining your control systems to eliminate waste and duplication. Here are a few examples of this special way to save paper:

15 TONS PAPER SAVED on 32 control systems through changes in form designs, sizes, after analysis by Standard.

6.6 MILES PAPER SAVED on annual usage of 50,000 forms when Standard combined two forms for one-time writing.

20,000 SHEETS PAPER SAVED when analysis of three related records showed that one could be eliminated.

There are opportunities like this in *every* business. Possibly control systems and accounting records in *your* plant are consuming far more paper than necessary . . . and using up precious time, energy, manpower and equipment.

Standard Specialists at Your Service... to study accounting and control systems in your plant, suggest ideas for simplifying paperwork and saving paper. No charge. No obligation. Just part of our War Service to American Industry.

The Standard Register Company, Dayton 1, O.

Standard is the originator, in continuous business forms, of these distinctive marginally punched holes which are Marks of Identity of the continuous forms of The Standard Register Company—"the Forms with the Punch."

THE STANDARD REGISTER COMPANY
101 Albany St., Dayton 1, Ohio

Send your FREE CHART showing the "nerve system" of industry and how to "save paper by the mile" . . . in 61 places.

NAME_____ TITLE_____

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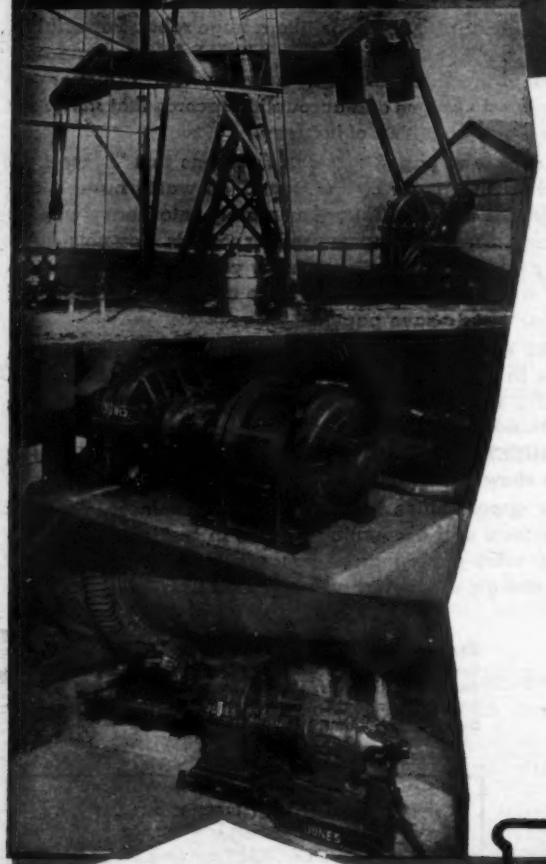
JONES DRIVES FOR INDUSTRY



★ For many years the W. A. Jones Foundry & Machine Company has been called upon as a consultant, to help solve a great variety of difficult drives involving the use of speed reducers, gears and other transmission machinery. In many cases these installations have called for the development of special equipment, designed and built to suit the specific requirements of the project.

As a result of these years of experience, involving numerous special problems in the mechanical transmission of power, the Jones organization has collected a vast amount of technical data relating to work in various fields.

Specific bulletins and catalogs are available on the products listed below and a general 20 page bulletin "Jones Drives for Industry" presents a broad picture of Jones products, engineering services and manufacturing facilities.

W. A. JONES FOUNDRY & MACHINE CO.
4433 Roosevelt Road, Chicago 24, Illinois

JUST ASK FOR BULLETIN NO. 80.

• These illustrations show application of Jones drives to solve a wide range of industrial power transmission problems.

Jones

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS • CUT AND MOLDED TOOTH GEARS • PULLEYS
ANTI-FRICTION PILLOW BLOCKS • V-BELT SHEAVES • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

FIRST TIME UP

Big C-46 Transports Go Up First on Cleveland Tramrail

The hundreds of giant C-46 Curtiss Commando Air Transports being turned out in a New York State plant of the airplane Division of Curtiss-Wright Corporation, get their first boost upwards with the new 10-ton Cleveland Tramrail transfer bridge system.

In fact they get several rides during construction. The various fuselage sections, wings, engines, and other parts are brought together by means of the bridges which may be interlocked, enabling the transfer of loads from one bridge to another.

Cleveland Tramrail is playing a major role in speeding production of these famous "Streamlined Flying Freighters." The vast area of the entire assembly floor is completely covered with Cleveland Tramrail equipment.

Curtiss-Wright engineers are proud of their Cleveland Tramrail installation. Especially pleasing to them is the heavy construction and precision workmanship of Cleveland Tramrail which makes the equipment practically trouble-proof and smooth operating.

All Curtiss-Wright plants and many other leading aircraft factories are served by Cleveland Tramrail.

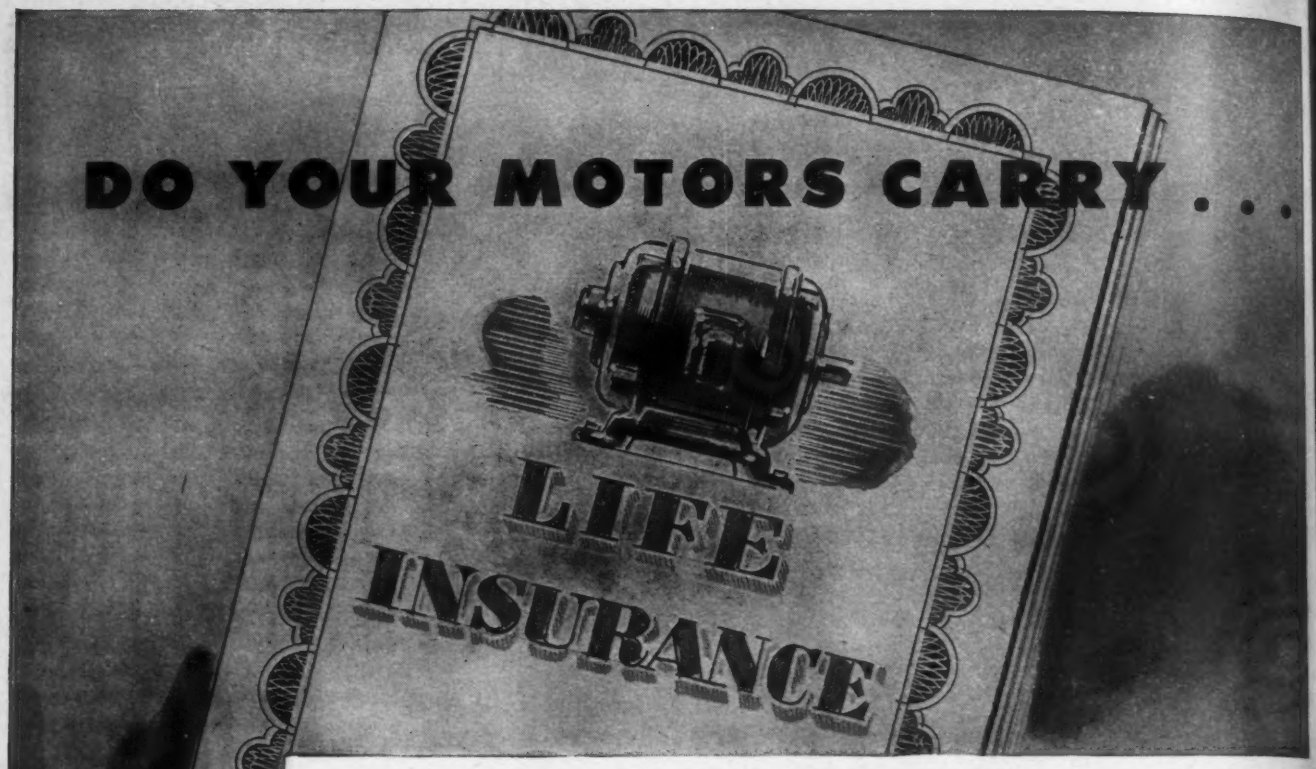
GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1187 EAST 283RD ST. WICKLIFFE, OHIO.

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT



The life of a motor is no longer than the life of its bearings. Bearing failure means motor failure and shutdowns. And the bearings may fail for any or all of the following reasons:—(a) poor design and construction; (b) neglected lubrication; (c) use of lubricant of poor quality; (d) dust and dirt in the bearings.

MOTOR MANUFACTURERS WHO HAVE ADOPTED NORMA-HOFFMANN "CARTRIDGE" BALL BEARINGS ARE PROVIDING THEIR CUSTOMERS IN-BUILT MOTOR LIFE INSURANCE--IN EFFECT, A GUARANTEE OF LONGER, MORE TROUBLE-FREE, LOWER-COST MOTOR PERFORMANCE—because:—

A. The "CARTRIDGE" BEARING is a NORMA-HOFFMANN PRECISION product, designed EXPRESSLY to meet electric motor requirements.

B. With its double-row width, the "CARTRIDGE" BEARING provides WITHIN ITSELF a supply of lubricant at least twice that of any other single-row ball bearing.

C. The "CARTRIDGE" BALL BEARING is loaded at the factory with NORMA "STABILITY-TESTED" GREASE—a high-duty lubricant which has exceptional life and a wide temperature range, and moreover is chemically stable and water-repellent.

D. The highly efficient, wearless metal seals of the "CARTRIDGE" BEARING, so effective in KEEPING LUBRICANT IN the bearing, are equally effective in KEEPING DUST AND DIRT OUT. And they are removable and replaceable, making bearing inspection easy.

These, and other, distinctive features explain why so many motor manufacturers, seeking to assure their customers MAXIMUM MOTOR LIFE, have adopted NORMA-HOFFMANN "CARTRIDGE" BALL BEARINGS for their latest and most efficient motor models.

Ask for motors carrying the "life insurance" that NORMA-HOFFMANN "CARTRIDGE" BEARINGS provide. They will be a sound and lasting investment, returning good dividends in lower costs, longer life, and freedom from snutdowns.

NORMA-HOFFMANN BEARINGS CORP'N, STAMFORD, CONN. FOUNDED 1911

TO WIN THE WAR • WORK • FIGHT • BUY WAR BONDS

LIFTING MACHINERY is only one of many Porto-Power uses. Simple attachments "harness" the hydraulic ram for "toe lift." Other combinations serve push, pull, bend, clamp and press jobs—over any span—any angle!
NOTE: TOE LIFT
Porto-Power
HELPS YOU STAMP OUT
CROWBAR-ITIS
WHY WASTE VALUABLE MANPOWER? Porto-Power raises a machine more quickly — more safely — with fewer men than are used where "crowbar-itis" reigns! Watch other crude, time-wasting practices disappear, too, when Porto-Power is at your service!

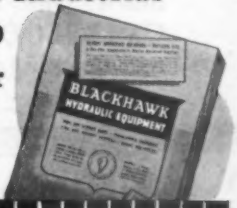
WHEN you see a crowbar in the sweaty grasp of men . . . *investigate!* It may be a bad case of "crowbar-itis," reaping its toll of wasted man-hours and costly damage.

"Crowbar-itis" is the malpractice of using a crowbar on jobs that could be handled more efficiently by Porto-Power.

Porto-Power is a *hydraulic* device that boosts the power of one man *up to one thousand times.* It's *controlled* power, too!

It replaces dangerous, damaging, time-wasting methods and does 1001 maintenance, production and construction jobs faster, more easily, with fewer men, greater safety and without damage to machinery.

Porto-Power is war-power today! It is available through your Blackhawk Industrial Distributor in 7, 10, 20 and 50 ton capacities. Call him — or write us today for literature.



A Product of

BLACKHAWK MFG. COMPANY

Department P2724 • Milwaukee 1, Wisconsin

ARMY NAVY

BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P2724, Milwaukee 1, Wis.
Please rush Blackhawk Hydraulic Equipment Bulletin V-43.

Name.....

Firm.....

Address.....

PANCAKE WIREMOLD

QUICK and EASY WAY to make FLOOR SPACE more productive!

● Every plant, every office building, schools, laboratories, hospitals, constantly face problems of efficiently utilizing available floor space and frequent relocation of working units. Pancake Wiremold, the safe, simple OVERFLOOR Wiring System quickly takes care of required wiring connections . . . to desks, work-benches, appliances and machines . . . for work lights, telephone, control or signal systems. Uses minimum critical materials. Fast, easy installation . . . readily extended . . . connects to existing panels or wall outlets.

PHONE, LIGHT OR POWER OUTLETS . .

A few well designed standard fittings meet every requirement. Dangerous long extensions are eliminated, maintenance is reduced to a minimum.

INSTALLED WITHOUT DISTURBING WORKERS

Pancake, like other Wiremold Systems requires no channeling of floors or walls, can be installed without special tools, entails no pipe threading or waste. Slip joint connections are quickly made yet permanent, safe. Conforms to Federal Specification W-R-32; Listed by Underwriters' Laboratories.

Write for your copy of the Wiremold Catalog and Wiring Guide detailing this and other Wiremold aids to greater lighting and electrical efficiency.

The Wiremold Company, Hartford 10, Conn.

WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . AND PLAN FOR PEACE

REPUBLIC
RUBBER
HOSE
Designed
Specifically
ervice
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Distributor
See your Republic Distributor
A blast of compressed air usually carries lubricating oil from compressor to pneumatic tool. So, in addition to construction for handling high pressures, Republic Pneumatic Hose is built with an oil-resistant inner tube. Working conditions require a non-crushable carcass and a tough cover to withstand abrasion from rocks, concrete or other materials. The designs of steam hose, fire hose and oil drilling rotary hose are as exacting in construction needs. Through years of research, engineering and manufacture, Republic Rubber has developed hose designed for specific uses. Your Republic Distributor is qualified to advise you on the type and quality to render the service you need. Ask him about Republic Rubber Hose.
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DIVISION OF
LEE RUBBER & TIRE CORPORATION

"He Straightens Out Our Delivery Tangles"

Keeping data "in one's head" is fine—in its place. But to keep mental tabs on all the complicated operations of a modern business would strain the powers of even a Hindu mystic!

What's needed are *records*—records of orders, of deliveries, and of every stage of manufacturing operations. Records that give complete and accurate control of all processes, all transactions.

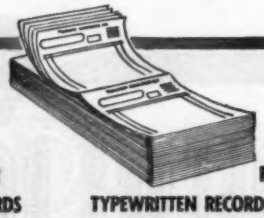
Supplying modern record forms to business is Uarco's job. Tailored to individual needs, Uarco forms routinize complicated operations—remove the guesswork—speed and simplify the work. And because Uarco has been doing that job for years, you can be sure that Uarco record forms, either autographic or typewritten, give you the latest, most up-to-date assistance.

If you have a special problem concerning business forms or records, bring it to Uarco. They will consider it a privilege to study your problem and to work with you in solving it with Uarco forms. Just have the Uarco representative call!

UNITED AUTOGRAPHIC REGISTER COMPANY
Chicago, Cleveland, Oakland • *Offices in All Principal Cities*

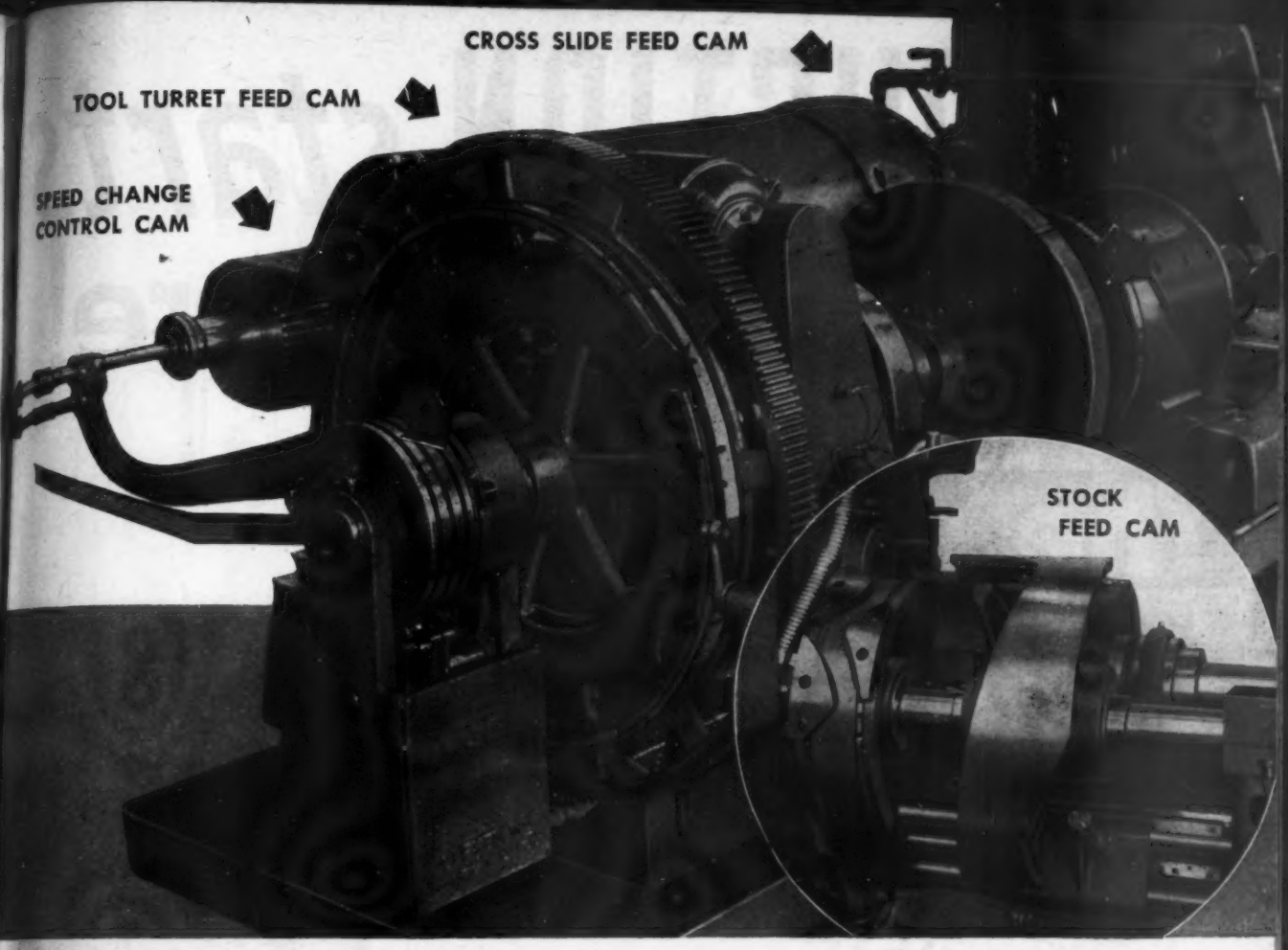
UARCO

FORMS FOR HANDWRITTEN RECORDS


FORMS FOR TYPEWRITTEN RECORDS

FORMS FOR BUSINESS MACHINE RECORDS

BETTER BUSINESS RECORDS



CLEVELAND UNIVERSAL CAMMING HELPS IN SOLVING YOUR MAN-POWER PROBLEM

MODERN production, be it on munitions or "civilian goods", constantly faces the need to make time savings on each operation on every machined part, to give each man *the power to produce more,* both for the assembly line and for himself. Clevelands help to solve such problems, not merely because they are fully automatic, but also because of exclusive Cleveland production speeding features. A good example is universal camming, which greatly reduces the time required for set-ups and adjustments.

Every operation on a Cleveland Single Spindle Automatic is controlled by standard cams. Quick settings are made possible by this Cleveland feature, and when a set-up is made, the Cleveland speed of production on multiple operations is such that savings commence within a very few pieces after the run starts. That's another reason why Clevelands have a wide reputation for . . .

1. Maximum sustained production on long runs, with minimum down time for adjustments.
2. Profitable economy on small lot, short run jobs.

Just Remember, Clevelands Cut Costs

THE CLEVELAND AUTOMATIC MACHINE COMPANY
CLEVELAND, OHIO

CHICAGO: 20 North Wacker Drive, Civic Opera Building, Room 1408
DETROIT: 540 New Center Bldg. CINCINNATI: 1315 American Bldg.
NEWARK: 902 American Insurance Bldg.

CLEVELAND
Single Spindle
AUTOMATICS

MODEL A—Built in 1 1/16-inch to 9 1/2-inch capacities
MODEL B—Built in 1 1/16-inch to 2 1/2-inch capacities

PRODUCTION *starts* here!

ARROW-H & H Thermal Switches

FOR SUSTAINED OPERATION

Size "0"

ACROSS-THE-LINE TYPE (L.L.): silver-plated contacts, with knife action. Full-floating, self-aligning movable contacts. Spring-reinforced, thermal overload protection by bimetallic action. Manually-operated trip-free mechanism; positive, smooth action; Bakelite base.

YOUR PRODUCTION-drive *starts* at the MOTOR drive of each individual machine. And this, for utter dependability, starts with an ARROW-H & H Switch . . . You have to *hold* machines to the critical peaks without risk of motor overloads. This, too, with utter dependability you can entrust to an ARROW-H&H Switch . . . Specify these "Load Limit" Thermal Switches for overload protection for polyphase motors up to 2 H. P., 440 V., A. C. or 1½ H. P., 230 V., D. C. For single-phase motors to 1½ H. P., same voltages. Interchangeable heaters provide 28 different ratings without special fusing. Ask for Catalog 9M, with engineering recommendations for *special* control problems.

INDUSTRIAL CONTROL DIVISION

ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

STANDARD CARBOLOY TOOLS Give You *Top Quality! Top Performance!*

. . . at prices comparable to all types of Cutting Tool Materials

DIAMOND GROUND
FULL-SIZE TIPS
CARBOLOY
look for these trademarks
COPPER BRAZED
COLD-DRAWN STEEL SHANKS
THESE FEATURES MEAN LONG TOOL LIFE, EXTRA TOOL STRENGTH, GREATER ADAPTABILITY TO SPECIAL SHAPES

THESE are the quality features you get with every Standard Carboloy Tool:

Cold drawn steel shanks—with the strength to "take it" on even the "toughest" jobs. Full-size Carboloy Tips—amply large to permit grinding to wide range of special shapes. Extra-strong braze—copper braze—of tip to shank. Cutting rakes and angles accurately incorporated for wide range of work. Each tool diamond-ground, ready to *start* cutting and *keep* cutting for long periods of operation. Entire tool shank area colored for instant, unmistakable identification.

These and other quality features of Carboloy Standards are available to you at prices comparable to all types of cutting tool materials—prices made possible by unprecedented demand and mass production economies.

Stocked in 10 styles, wide range of sizes and five standard grades.

CARBOLOY COMPANY, INC.
11135 E. 8 MILE AVE., DETROIT 32, MICHIGAN
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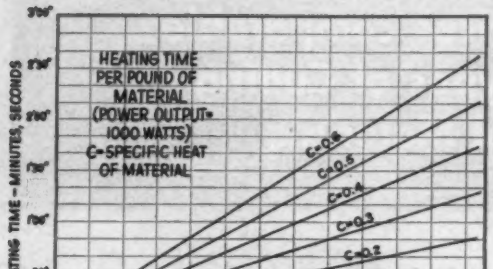
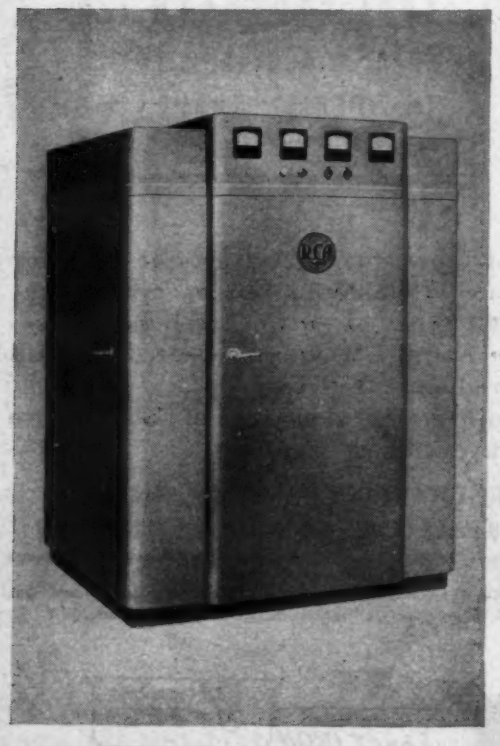
CARBOLOY TRADEMARK — For Cutting CAST IRON and Non-Ferrous Metals — For Cutting STEEL

TUNGSTEN CARBIDES * * * TUNGSTEN CARBIDES WITH TANTALUM AND/OR TITANIUM CARBIDES

DO YOU HAVE A FAST, UNIFORM,



● *Estimates of heating time and power required for a given job can be based on this chart.*



● *Here's the compact RCA 15B generator—output 15 kilowatts, about 48,000 B.T.U. per hour.*

How Does Electronic Heating Work? Many substances which are electrical insulators for direct current or low-frequency alternating current tend to become conductors when subjected to high-frequency alternating currents. Substances vary, of course, but in general this effect becomes noticeable at frequencies above 1 million cycles per second, and increases as the frequency increases.

Thus, if sufficient current can be passed through the substance, an appreciable heating effect will be noted.

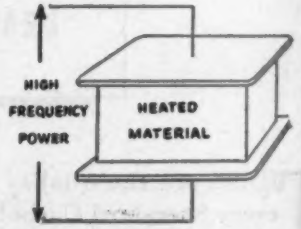
What About Results? *Uniformity:* If the current is uniformly distributed as it flows through the heated substance, the heating will be uniform—*not just at the surface, but all the way through the material.*

High Speed: This makes high-speed heating possible, since there is no delay caused by waiting for heat to seep from the outside to the inside of the piece.

Better Quality: With some materials the critical temperatures and the heating-time cycle are closely linked, so that external heating methods, which produce uneven heating, will cause varied chemical composition, and will often leave internal stresses in the material when it has cooled.

How Is Heat Applied? The substance to be heated is placed between two metal plates, and high-frequency power is applied across them.

The plates form an electrical condenser (or capacitor), and the heated substance is the "dielectric" of the condenser.



Where Can It Be Used? *Material:* This unique method of heating, called "dielectric" heating, can be applied to a wide variety of substances, such as: wood, plastics, rubber, foods, tobacco, ceramics, textiles, paper, chemicals, and many others. Some materials will heat better than others.

Shape: Dielectric heating is best applied to objects of uniform thickness, cross section, and composition. Some flexibility is possible, however. For example, plywood can be heated (for bonding) between curved plates.

Thickness: Heating is uniform regardless of the thickness of the material; that is, a thick piece can be heated as uniformly as a thin piece. Thus, this method is especially advantageous for thick sections.

Area: There are some restrictions as to the area (not volume) that can be heated at one time due to electrical limitations. Large areas may in some cases present problems.

Volume: The volume of material that can be heated at one time depends on several variables: material to be heated, speed required, power unit available, type of process (batch or continuous).

A PROCESS THAT NEEDS ELECTRONIC HEAT?

Is Electronic Heat Efficient? Electronic generators convert from 50% to 75% of the power-line energy they use into high-frequency power that can be delivered to the load. Since there are no platens to heat, and since the heating cycle is usually so short that radiation and conduction losses are very low, nearly 100% of the high-frequency power delivered to the load is converted into *useful* heat.

How Much Power Is Needed? The formula: $P = 2.93 \times 10^{-4} MCT$ gives the kilowatts needed to heat a substance, where M = pounds per hour of material; C = average specific heat of the material; and T = temperature rise in degrees F. Several other factors must be considered in order to determine the actual electronic generator power required.

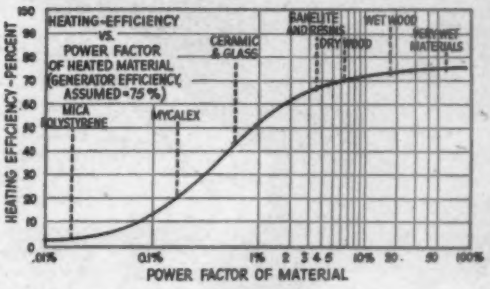
The cost per 1000 B.T.U. may be as low as 1 cent, including tube replacement.

What Equipment Is Required? The only equipment needed for electronic heating is an electronic generator (see photo) and its associated electrical leads and coupling unit (in some cases) for putting power into the load. The generator takes power from standard AC lines. The power factor of the generator is about 85%.

Is Equipment Available? Standard RCA electronic generators can be obtained on priority in ratings up to 100 kilowatts output. (See coupon.)

Installation and Service. RCA engineers supervise installation; the RCA Service Company—specialists in electronic equipment servicing—will keep your equipment in tip-top condition on a yearly maintenance contract basis.

How About Your Application? RCA electronic application engineers will be glad to help you apply electronic heat to your manufacturing processes. Write, stating kind of material, shape, size, amount to be heated per hour, and other pertinent details. Address: RCA, Dept. 70-43B, Camden, New Jersey. Or send the coupon for further information.



● *Assuming a 75% efficiency for the electronic generator, the overall efficiency of an electronic heating installation depends on power factor of the heated material, as shown.*

FREE!

(Please check items wanted)

☐ Bulletin "RCA Electronic Power Generator Model 2B"—2 kilowatts output.

☐ Bulletin "RCA Electronic Power Generator Model 15B"—15 kilowatts output.

☐ "Molding with Radio-Frequency"—a 4-page article on electronic heat for plastics molding.

☐ "Heating Wood with Radio-frequency Power"—a 12-page article from "Transactions of A.S.M.E.

RCA, Dept. 70-43B, Camden, N. J.

Gentlemen:

Please send me the items checked above.

Name_____

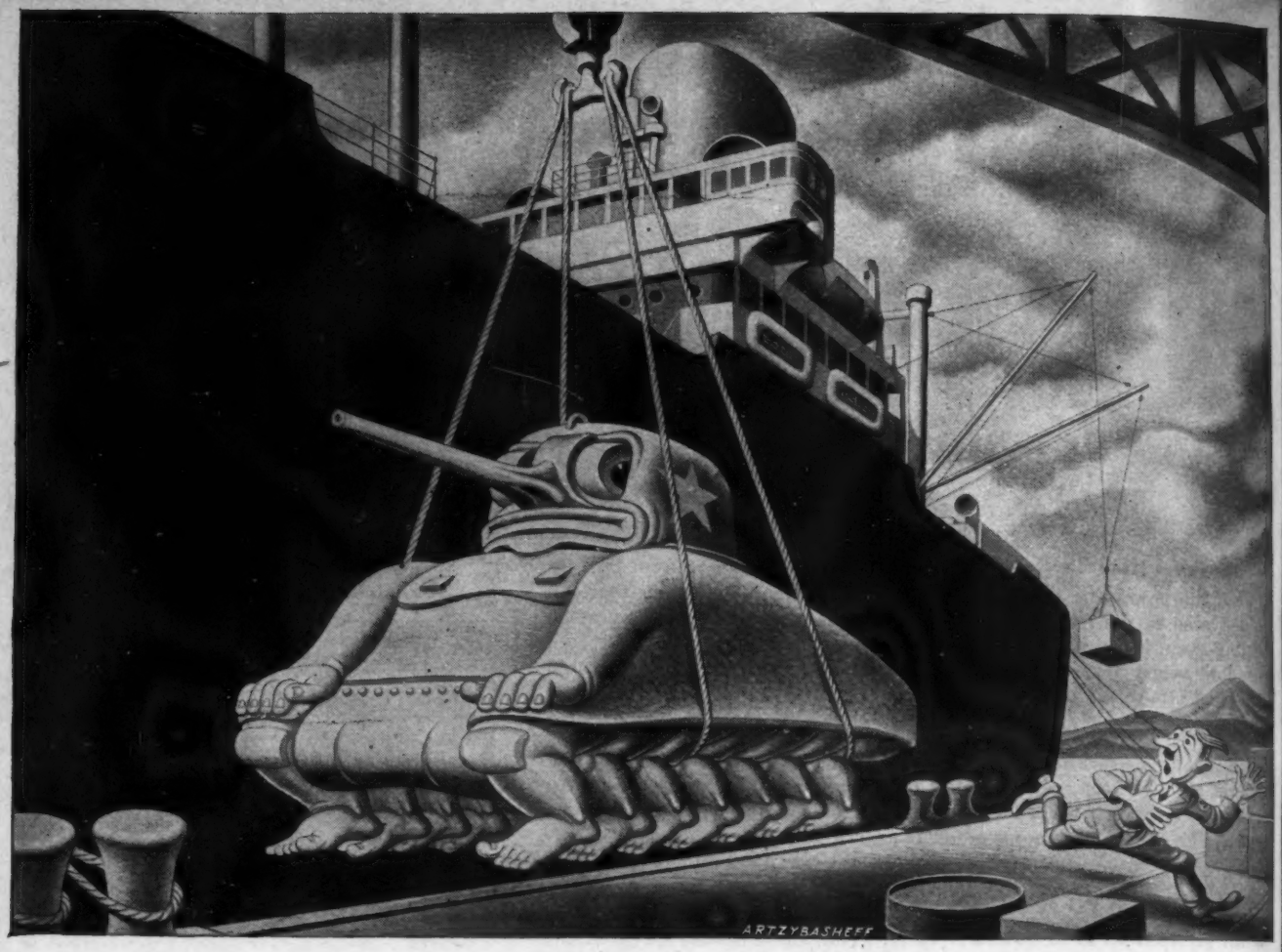
Company_____

Address_____

City_____ State_____

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA



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If this Tank could *talk*...

"Do you know this buddy of mine who's setting me ashore to start erasing Nazis? Let me tell you about him. I first learned what a stout, dependable friend Wickwire Rope is at the mine, where I was just red ore. Then he helped make some of my fine steel parts; and to build me . . . and dig wells for my fuel. In every industry, and on our Liberty Ships, you'll find friendly Wickwire Rope, serving silently and dependably. He'll be serving on the trip to Berlin, too."

• • •

For 122 years Wickwire Spencer has specialized in steel wire and wire products, pioneering many of the industry's important achievements. Wherever quality and service count, that name has won a reputation we aim to continue. Let Wickwire Spencer engineers help on *your* war production—and in your planning ahead.

WILL *YOU* HELP?
Every foot of famous WICKWIRE quality rope is needed to help in vital war production here at home, on the Victory Ships, and at the fronts. YOU can help by making the wire rope YOU use last longer.

FREE BOOK TELLS HOW

Its 82 pages contain:
78 pictures of right and wrong ways
41 wire rope life savers
20 diagrams, tables, graphs and charts

SEND FOR YOUR FREE COPY.

Send your wire rope questions to:

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500 FIFTH AVENUE, NEW YORK 18, N. Y.

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15%-30% more production with the WILSON "BUMBLEBEE"

Here's why the Wilson AC welding machine is boosting welding output by 15% to 30% in many metal-working plants. The "Bumblebee" puts a real sting into the arc – makes it deep and penetrating and almost wholly free of "arc blow". As a result welding output is notably increased while weld quality is considerably improved.

In addition, the "Bumblebee" reduces power costs – using 30% to 35% less power to do the same amount of work as an equivalent DC machine. Built-in capacitors provide improved power factor, which helps to reduce power bills, and permits operation of more welders from existing shop lines without causing overload. Maintenance, too, is easier because the "Bumblebee" has no heavy rotating parts.

The Wilson "Bumblebee" is made in 300 and 500 ampere capacities. Special running gear assembly can be supplied (at slight extra cost) where portability is desired. The "Bumblebee" is also made in "All-Weather" models which have extra moisture protection throughout, as well as automatic low open-circuit voltage controls.

Other Wilson AC welders are available in sizes from 100 to 1000 amperes capacity. There is a complete line of Wilson AC electrodes for every AC welding requirement.

WILSON

WILSON WELDER and METALS CO., INC.

General Offices: 60 East 42nd Street, New York 17, N. Y.

In the U.S.A. WILSON AC WELDERS — *distributed through the Air Reduction Sales Company*

In Canada: G. D. Peters & Co. of Canada Limited • Birks Bldg. Montreal

SEND FOR *FREE* CATALOG

WILSON WELDER AND METALS CO., INC.
Department F
60 East 42nd Street, New York 17, N. Y.

Please send me Catalog ADW-53 giving full details on the WILSON "BUMBLEBEE".

NAME_____

COMPANY_____

ADDRESS_____

CITY & STATE_____

TRUMBULL

CIRCUIT BREAKERS • NO FUSE SWITCHES • MAGNETIC STARTERS

IN EXPLOSION PROOF ENCLOSURES

WHERE YOU NEED THEM. These enclosures are designed to make standard Trumbull Electric Control Equipment SAFE for hazardous locations, and in atmospheres containing gasoline, petroleum, naphtha, acetone and lacquer solvent vapors, natural gas and other volatile liquids (National Electric Code Class 1—Group D also NEMA type 7).

Enclosures are precision made of cast semi-steel; covers bolted to box, metal to metal, machined matching surfaces. They are equipped with corner mounting lugs and attractively finished in machine gray enamel. Switches can be locked "on" or "off" . . . circuit breakers have front operation.

CONDENSED SPECIFICATIONS

"RBA" HEAVY DUTY INDUSTRIAL "Type A" Switches — no fuse — 30, 60 and 100 amps. — 2 and 3 pole —250V. D.C., 230-575V. A.C.

MAGNETIC STARTERS—Sizes 1, 2 and 3 — 3 pole — 110-600V.

MANUAL STARTERS — Type "TT" — Size 00; Type "RB" — Max. 2 H.P.

"AT" CIRCUIT BREAKERS—15 to 600 amp.—2 and 3 pole — 250V. D.C., 600V. A.C., Also 1 pole 125V. A.C. and D.C.

Trumbullaid Circular 315

TRUMBULL
ELECTRICAL CONTROL EQUIPMENT

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

MANAGEMENT says "YES"

"Since the installation of MUZAK, our production has been more consistent, has, in fact, definitely increased. But most important of all, our use of music has created 100% harmony in all of our departments, and we are highly pleased with the results... **In fact, we intend to extend MUZAK to all our plants."** *(Name on request. See list of typical MUZAK users on right.)*

LABOR says "YES"

"MUZAK is an outstanding fatigue-killer, especially when they hit the slow time around 3:30. It's the best morale builder they've ever had in our plant. You can notice the people on the night shift. **They used to drag when they came on for their ten-hour shift. Now they practically dance up to their machines."** *(This is the comment of the President of Employees' Union. Name on request.)*

GOVERNMENT says "YES"

WPB has just completed its own survey of music in war plants, based on over 100 plants all over the country. It reports that *"the longer music was offered workers, the greater the effect on morale and production"*... **and strongly endorses music-while-you-work to all Labor-Management Committees.**

SCIENCE says "YES"

Professor Burris-Meyer of Stevens Institute of Technology has made many carefully controlled studies of the effect of music-in-industry. He reports *a decrease of 66%* in man-hours *lost through early departures in one plant.* **The *only* factor changed was music played during working hours!**

MUZAK

"WHILE-YOU-WORK"

is now a tool of production at . . .

Bendix Aviation Corporation
Bulova Watch Company
Cannon Electric Co.
Champion Spark Plug Co.
Chemical Construction Co.
Cleveland Graphite Bronze Co.
Cluett, Peabody & Co., Inc.
Consolidated Shipbuilding Corp.
E. I. DuPont DeNemours & Co., Inc.
Thomas A. Edison, Inc.
Fairchild Aircraft, Ltd.
General Foods Corp.
Grumman Aircraft Corporation
Hickok Electrical Instrument Co.
Richard Hudnut
Leeds & Northrup Co.
Loft Candy Company
Mentholatum Company
Carl L. Norden Co.
(Norden Bombsights)
Otis Elevator Company
Pepsi-Cola Company
Polaroid Company
Rolls Royce, Inc.
S K F Industries, Inc.
Southern California Gas Co.
Sperry Gyroscope Company
E. R. Squibb & Sons
John B. Stetson Co.
Westinghouse Elec. & Mfg. Co.
Weston Electric Instrument Co.
Wright Aeronautical Corp.

. . . and many others.

MUZAK sends *planned* programs, especially designed for industrial use, direct by wire to your plant or office. There are NO phonograph records to buy (and break); NO operators required in the factory.

Every MUZAK installation can be used as a "public address" system *at any time* for paging executives, etc. MUZAK can also be delivered directly to your present "public address" system if it is of proper quality.

Write or telephone for complete information

MUZAK* PLANNED MUSIC FOR INDUSTRY

NEW YORK—MUZAK Corporation, 229 Fourth Ave.
BOSTON—The Colonial Network, 10 Kenmore St.
BUFFALO—Transtudio Corporation, 473 Virginia St.
CLEVELAND—Ohio Music Corporation, 1120 Chester St.
DETROIT—Michigan Music Company, 112 Curtis Bldg.
LOS ANGELES—The Pacific Network, Inc., 2625 Wilshire Bldg.
MIAMI BEACH—Florida Music Corporation, 940 Lincoln Road Bldg.
PHILADELPHIA—Muse-Art Corporation, 526 Schaff Bldg.
WASHINGTON—Music Incorporated, 912 Sixth St., N.W.
MONTREAL—Associated Broadcasting, Ltd., Dominion Square Bldg.
TORONTO—Associated Broadcasting, Ltd., Central Bldg.

*Reg. U.S. Pat. Off.

New! FLUORESCENT Luminaires

FOR ESSENTIAL WARTIME APPLICATIONS

For better illumination of war-production offices and drafting rooms, Westinghouse introduces a new line of Commercial-type, Fluorescent Luminaires. Used as individual fixtures or for continuous strip installations, they furnish a wide range of high intensities . . . and without shadows or glare.

Handsome in appearance and sturdily built, these efficient luminaires are *now* available through 117 Westinghouse Electric Supply Company offices and Independent Westinghouse Lighting Distributors.

Get full details today! Or write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, Ohio, for bulletin B-3332.

Easily Installed

IN ANY ONE OF 4 WAYS

1. As individual units, with twin-stem hangers.

2. As individual units, mounted flush with the ceiling.

3. For continuous strip applications, with twin-stem hangers.

4. For continuous strip applications, mounted flush with the ceiling.

Westinghouse Commercial-type Fluorescent Luminaires are available with or without the glass panels illustrated above.

Westinghouse *Lighting Equipment*

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in John Charles Thomas, NBC, Sundays, 2:30 P.M., E.W.T.

AHON *Coordinated* FINISHING SYSTEM

AVE ESTABLISHED EMARKABLE RECORDS IN OOSTING PRODUCTION OUTPUT . . . . .

with less men ★ in less time ★ at less expens

In the Finishing Departments of many war production plants, Mahon engineers have accomplished exceptional results in combating delays and slowdowns. Increased production with decreased manpower is continually being achieved by the institution of more modern finishing methods—by revision and re-arrangement of plant and production layouts—by replacing obsolete and inefficient machinery with *faster* and *better* equipment.

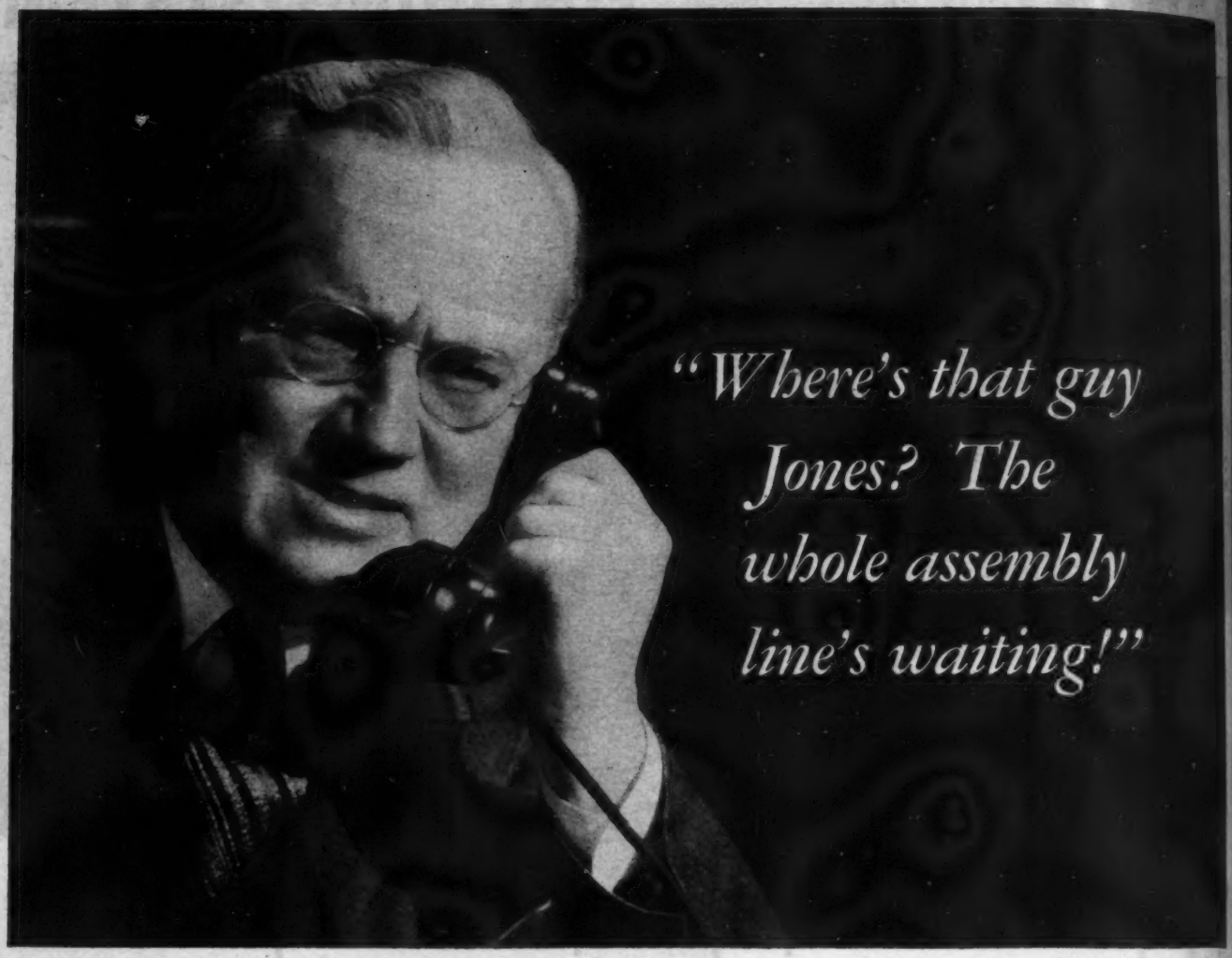
Your entire FINISHING problem—cleaning, rust-proofing, painting, drying and baking—can be turned over to Mahon's engineering staff with complete confidence. The Mahon organization, backed by years of research and practical experience in this highly specialized field, can be depended upon to do a thorough engineering job in converting your Finishing operations into a balanced, fast-moving production line.

Keep in mind *after-the-war* requirements when planning Finishing Equipment to speed *present* production, Mahon co-operation can be particularly helpful.

THE R. C. MAHON COMPANY

DETROIT CHICAGO

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems



FIND YOUR MAN FAST WITH A SOUND SYSTEM!

No matter how many employees you have ... or how large your plant is ... you can find your man in a flash with "straight-line" communication.

It reaches one man ... or a thousand ... *quicker* and *better* than by any other method. It saves manpower ... relieves congested long distance lines ... and increases efficiency. In fact, this system will pay for itself in an amazingly short time in man-hours alone.

Let us help you solve your communication problems. Stromberg-Carlson communication equipment is available now on a regular priority basis. We can apply half a century of experience in this field to help you speed production and promote safety in your plant.

Write for Booklet No. 42. Sound Equipment Division of the Stromberg-Carlson Company, 100 Carlson Road, Rochester 3, New York.

ARMY E NAVY

STROMBERG-CARLSON

STRAIGHT-LINE COMMUNICATION SAVES MANPOWER • SPEEDS THE WORK TO VICTORY

Keep Backing the Attack — Buy MORE Bonds!

72°

70°

65°

50°

45°

40°

Zoned

FOR FUEL SAVING

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Zone control equipment, because of the fuel saving produced by this system, is of prime importance right now. Buildings, old or new, can be zoned for occupancy or for outside weather conditions. Both save fuel. In the former, heat is supplied to the various zones only to the degree needed; in the latter, overheating is avoided by supplying less heat on the warm side or sections of the building and more heat is supplied to the zone with the greatest exposure to the elements. Fuel savings resulting from Minneapolis-Honeywell Zone Control will pay its cost. The additional health, comfort and improvement in working conditions actually costs nothing. Minneapolis-Honeywell Regulator Company, 2706 Fourth Ave. S., Minneapolis 8, Minn. Branches and distributors in principal cities.

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LISTEN . . . Blue Jacket Choir, with Danny O'Neil, from Great Lakes Naval Training Station, Columbia coast-to-coast network, every Sunday morning 11:05 to 11:30 Eastern War Time.

MINNEAPOLIS **Honeywell**

CONTROL SYSTEMS

Herringbone gears—a Whiting Crane construction feature.

HOW to tell a *Good Crane*

The best crane for a particular job is not necessarily the most expensive one . . . nor the cheapest. A crane too lightly constructed, though it may be cheaper to buy, will have a short life with excessive maintenance costs. On the other hand, overweight construction and oversize motors mean high investment and operating costs.

For most purchasers the safest course is to place their materials-handling problems in the hands of dependable crane engineers whose experience enables them to choose exactly the motors, girders, bearings, gears, and controls that are most appropriate for the necessary purpose.

Owners of Whiting Cranes have deep respect for the operating economy and freedom from maintenance of their crane equipment. Let Whiting engineers analyze your needs and recommend cranes carefully designed to handle your specific jobs. Whiting Corporation, 15689 Lathrop Ave., Harvey, Ill.

Dependable · Quiet-Running · Durable

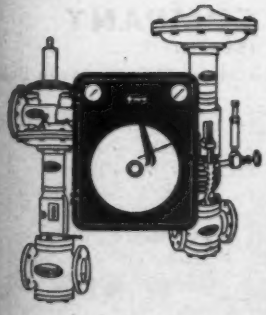
WHITING

Overhead Traveling **CRANES**

BUILDERS OF QUALITY CRANES FOR NEARLY 60 YEARS

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Washington, D. C. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario.

The 10,600-mile stretch...



Before the Japs had conquered the East Indies, America's scientists and chemists planted miniature rubber plantations in the United States by creating synthetic rubber.

From Massachusetts, 10,600 miles away, came Masoneilan controls which made possible the processes which have enormously stepped up the production of rubber . . . American made rubber . . . and prevented the loss of Far East supplies from being a major disaster.

MASONEILAN

MASON-NEILAN REGULATOR CO.

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"OK, that's settled . . . we'll always use AMERICAN PHILLIPS SCREWS . . . THEY'RE FASTER . . . SAFER . . . COST LESS TO USE"

The "get-it-done-or-else" demands of wartime have brought thousands of production men to see plainly the value of American Phillips Screws:

Speed of assembly often doubled . . . because there are no fumbled starts, or crooked screws to back out and re-drive. Spiral and power drivers are made practical, and the 4-winged bit aligns itself in the tapered recess of the screw head . . . drives automatically straight.

Greater safety . . . both for workers and their work. Driver can't twist out to gash hands, spoil work by gouging or puncturing, or leave any snagging burrs on screw heads.

Lower cost . . . savings of 50% in assembly time are not unusual with American Phillips Screws. Production is increased . . . workers are trained in less time . . . spoiled work and lost-time accidents are eliminated. Uniformly high quality is assured by American's constant research in materials and methods, and by individual inspection of screw head, thread, and point.

Now add the final extras of American delivery service and engineering assistance on special fastening problems . . . then you *know* why everyone who ever tried American Phillips Screws is using them today . . . *and why those who have come to use them in time of war will continue to use them in time of peace.*

AMERICAN SCREW COMPANY
PROVIDENCE, RHODE ISLAND

Chicago: 589 E. Illinois Street — *Detroit:* 502 Stephenson Building

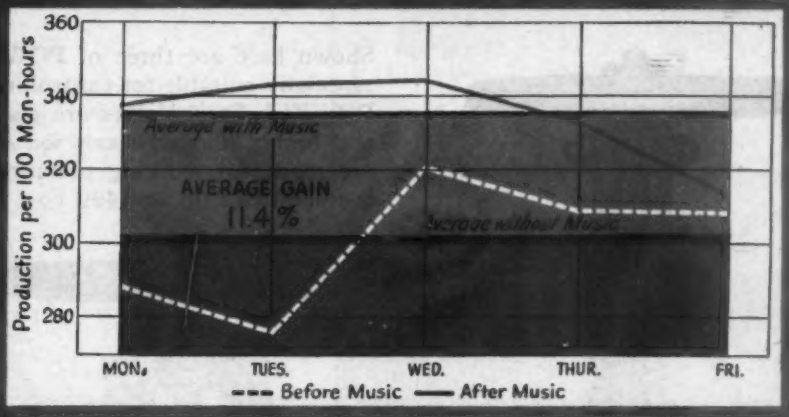
1. **Fast Starting**—Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

2. **Faster Driving**—Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

3. **Better Fastenings**—Screws are set up uniformly tight, without burring or breaking heads. A stronger, neater job results and there are no gouges on work-surface.

MUSIC BOOSTS WORKER EFFICIENCY

are results of actual tests conducted by the Stevens Institute of Technology. About 100 workers were checked daily for five days without music, and then for five days under the same working conditions *with* music. The curves show an average improvement of 11.4% in productive efficiency after music service was installed.



PRODUCTIVE efficiency is a good index of worker fatigue. If workers feel tired and nervous, productive efficiency will drop. But worker fatigue can be relieved by the use of *planned* industrial music—the kind of music provided by the RCA Industrial Music Service.

With music, your workers feel better—their spirits are higher—not just during the day, but at quitting time, too. They will go home happier, less tired.

Music is in this way helping to cut absenteeism in war plants all over the country! It reduces petty ailments (headache, etc.) which are caused by "jangled" nerves. That means fewer calls to the infirmary, less time-out, and better morale. These results are proved by actual tests, and can be reproduced in other plants.

Music can be used even in noisy areas.

RCA INDUSTRIAL MUSIC SERVICE

RCA provides complete electronic sound systems for all types of installations, plus a scientifically selected library of music chosen for industrial use from the vast RCA treasure house of recordings. The sound system can be used for paging and other communication service.

Subscribers to the RCA Industrial Music Library Service also receive the benefits of RCA psychological research, and the help of RCA specialists in planning plant broadcasting schedules.

The story of industrial music and what it offers you is told in the new booklet, "Manpower, Music, and Morale," sent free on request. Send the coupon, or write to RCA, Dept. 70-59B, Camden, New Jersey.

RCA INDUSTRIAL MUSIC SERVICE

RCA

FREE! This new 16-page book telling how to use music in industry, and what it can do for you.

RCA, Dept. 70-59B, Camden, N. J.

Please send "Manpower, Music, and Morale" to:

Name_____

Company_____

Address_____

City_____ State_____

RADIO CORPORATION OF AMERICA

POWELL VALVES

The Wm. Powell Company

Dependable Valves Since 1846

Cincinnati, Ohio

Valve Engineers to Industry

ASK POWELL FOR THE ANSWER TO ALL YOUR VALVE REQUIREMENTS

Shown here are three of POWELL'S complete line of Steel Valves especially suitable for controlling *steam* or *high pressure gas* lines. POWELL Steel Valves are also available in both plain carbon steel and highly alloyed steels for *process* lines. POWELL Steel Valves are made for working pressures from 150 to 2500 pounds and for temperatures up to 1400 F.

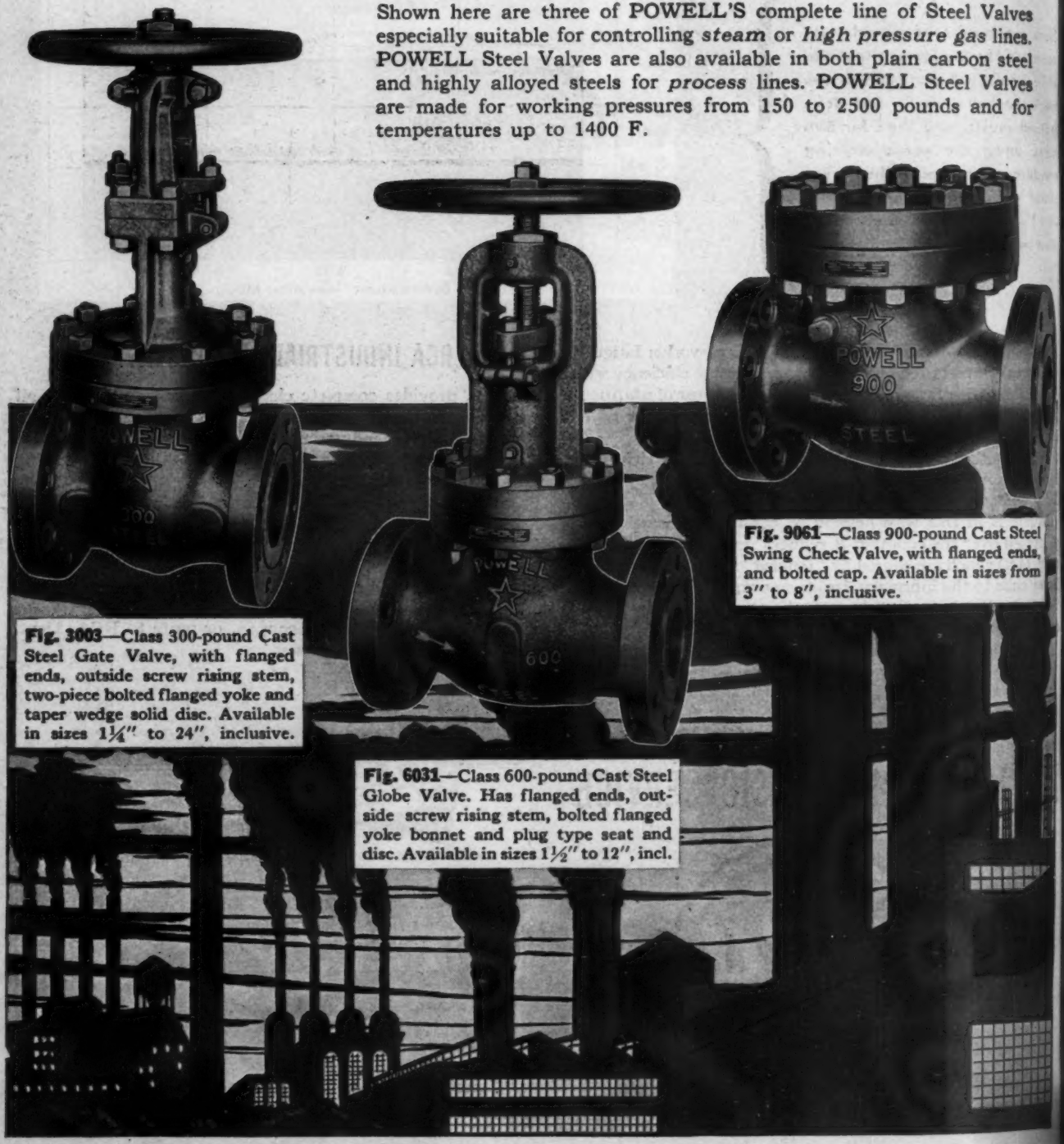


Fig. 9061—Class 900-pound Cast Steel Swing Check Valve, with flanged ends, and bolted cap. Available in sizes from 3" to 8", inclusive.

Fig. 3003—Class 300-pound Cast Steel Gate Valve, with flanged ends, outside screw rising stem, two-piece bolted flanged yoke and taper wedge solid disc. Available in sizes 1¼" to 24", inclusive.

Fig. 6031—Class 600-pound Cast Steel Globe Valve. Has flanged ends, outside screw rising stem, bolted flanged yoke bonnet and plug type seat and disc. Available in sizes 1½" to 12", incl.

esigning Molded Plastics Parts: THREADS

from the engineering files of One Plastics Avenue

Either standard or special thread forms may be incorporated in plastic parts design. Threads may be provided by one or more of the following manufacturing methods:

1. Molded integral with part.
2. Tapped after molding.
3. Molded in two sections of split mold.
4. Included as part of metal insert.

Choice of method requires close co-operation between designer and molder to insure economical production with proper tool construction.

In general threaded holes larger than ¼ inch should be molded; smaller sizes tapped after molding.

MOLDED THREADS

1. Start and end molded threads abruptly to eliminate feather edge on both molded part and mold sections.
2. Design pitch as large as possible to provide sufficient engagement of threads. Variations introduced by material shrinkage are thereby minimized.
3. Long molded threads are best designed to assemble with molded threads of same plastic materials to overcome shrinkage variations.
4. Fine threads are difficult to mold in high impact materials because of size of filler.
5. If thread-forming mold member is stationary in mold, provision should be made for unscrewing part from mold. A straight knurl or ribbed design is usually adequate for this requirement.

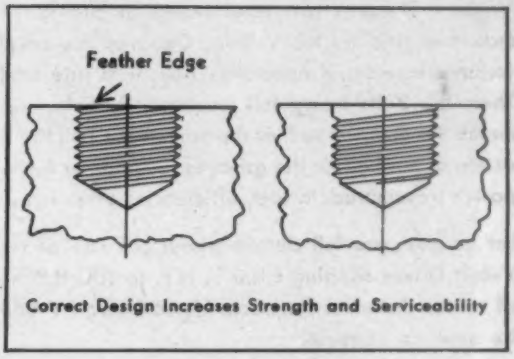
TAPPED THREADS

1. Tapped threads can be held to a Class II fit on most low moisture absorbing materials.
2. Mineral-filled compounds are difficult to tap without chipping. Fabric-filled compounds tap readily but the exposed cut surface may swell as moisture is absorbed.
3. Provide sufficient countersink at entrance of holes for tapping to prevent ridge against seating face of screw head.

OTHER THREADS

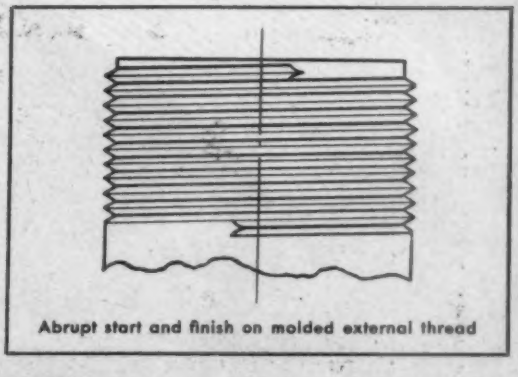
1. Provide threaded inserts where maximum strength is required or where frequent disassembly is anticipated.
2. Consider use of self-tapping screws or drive screws for permanent assembly.

ONE PLASTICS AVENUE at Pittsfield, Massachusetts, is the headquarters for five plants of the Plastics Divisions of the General Electric Company. It signifies the location of complete plastics facilities for development, material manufacture, designing, engineering, moldmaking, molding, and laminating.



Correct Design Increases Strength and Serviceability

"TYPICAL APPLICATION Used in an application requiring little stress on threads and infrequent removal of cover, this gage case of larger diameter is best designed with integral molded threads."



Abrupt start and finish on molded external thread

REPRINTS of this advertisement may be obtained by writing Section H-225, General Electric Co., Plastics Divisions, Pittsfield, Mass.

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC. "The World Today" news, every weekday 6:45 p.m. EWT, CBS.

GENERAL ELECTRIC

In the Groove
THE DIFFERENCE SHOWS

Wood's Sheaves are engineered to provide for a snug fit and maximum grip by the V-Belts. Grooves are precision machined, uniformly spaced and absolutely true, with side walls at proper angles. Then, the belts being full moulded, flexible and resilient, perfectly match the grooves so that the harder the pull the greater the wedging action of the belts in the grooves . . . and the higher the percentage of power transmitted. In fact, efficiencies often run as high as 98%.

Let us give you full details about our line of nearly 2800 Wood's V-Belt Drives ranging from ¼ H.P. to 100 H.P. with a wide selection of center distances for each. Our 64 page V-Belt Drive Catalog will be sent on request.

EVERYTHING IN TRANSMISSION
Bearings · Collars · Clutches · Couplings
Contactors · Hangers · Pillow Blocks · Pulleys
V-Belt Sheaves and Complete Drives.

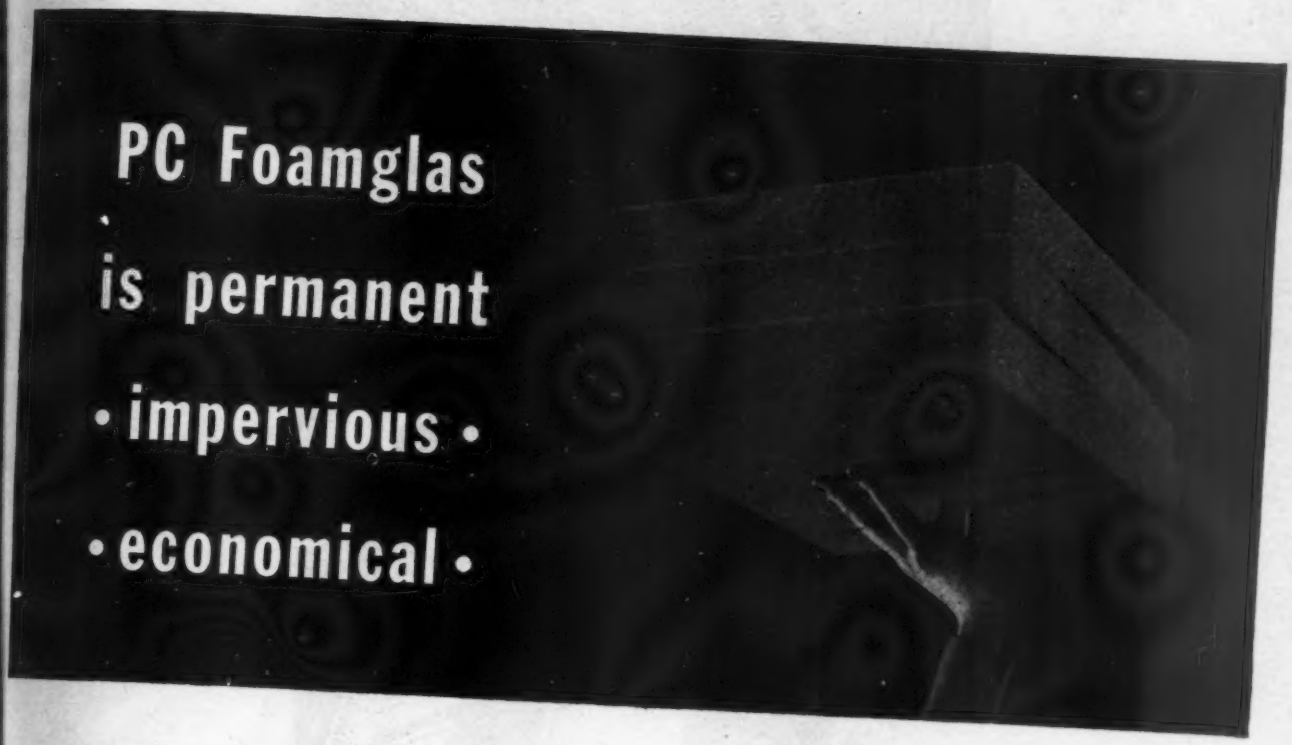
Wood's

V-BELT DRIVES

LONG LIFE LINE

T. B. WOOD'S SONS COMPANY
CHAMBERSBURG, PA.
BRANCHES: 387-391 ATLANTIC AVE., BOSTON, MASS. · 83 PLANE ST., NEWARK, N. J. · 425 FIRST AVE., PITTSBURGH, PA.

UNIQUE NEW INSULATION



● *Composed of millions of minute cells*—air trapped in glass—PC Foamglas defies heat and cold, withstands vapors and moisture, permanently . . . A non-priority material which you can get now.

Impervious to acid atmospheres and dampness — which cause many other materials to swell, warp, or rot and rob them of their insulating qualities — fire-resistant and vermin-proof, because it is glass—PC Foamglas is odorless and durable, does not deteriorate, therefore does not have to be replaced.

Rigid, yet light,—it weighs only 0.9 lb. a board foot—PC Foamglas is easy to handle. It can be trimmed and shaped right on the job when necessary, can be quickly installed. Think how much time, trouble and money this new insulating material can save you.

INCREASING need for rigid control of temperature and humidity, in chemical, textile, food and many other processing plants, brings increasing demand for the sort of roof insulation you get only with PC Foamglas.

When used as roof insulation, PC Foamglas is applied to the roof deck in accordance with standard insulation practice, then covered with your approved built-up roofing material. It retains its full insulation efficiency throughout the life of the building—is also used for insulating ovens, tanks and many other types of processing equipment. First cost is last cost when you use PC Foamglas.

SEND FOR FREE LITERATURE

We shall be glad to send you complete, detailed information about this unique, new insulation, telling how it can save you time, trouble and money, when you fill in and mail the convenient coupon.

PC FOAMGLAS

T. M. REG. U. S. PAT. OFF.

INSULATION

MAIL COUPON TODAY

Pittsburgh Corning Corporation
2052-4 Grant Bldg., Pittsburgh, 19, Pa.
Please send me, without obligation, your FREE literature on PC Foamglas.

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Address _____

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PLANNING AHEAD IN INDUSTRY

Now is the time to make your complete engineering plans for conversion and expansion. We have had 25 years' experience in furnishing preliminary recommendations and plant layouts —and in designing, building and equipping factories, warehouses and power plants, with one contract, one responsibility, one profit. We are serving many different industries. Our suggestions, based upon helpfulness to hundreds of important manufacturers, are yours without cost or obligation. Call or write our Cleveland, New York or Birmingham office.

The H.K. Ferguson Co.

ENGINEERS AND BUILDERS

CLEVELAND • NEW YORK • BIRMINGHAM

Omaha Public Library
Reference Dept.

Not even the finest, fastest hand tools can perform production miracles ... *but they help!* Throughout victory-geared industry, Snap-on tools are on the job ... helping speed America's incredible output of planes, ships, weapons. Snap-ons are *speed* tools, designed to help mechanics turn out *more* work and *better* work, with less effort and greater safety. Snap-on's direct-to-user tool service is available through 35 factory branches located in key production centers. Write for catalog of the complete Snap-on line.

SNAP-ON TOOLS CORPORATION

8044-B 28th AVENUE • KENOSHA, WISCONSIN

PREVENT TIME LOSS

Protect their hands against oils, grime and paint

Supply your workers with Du Pont PRO-TEK, the hand cream that acts like an invisible glove. Quickly applied to hands and arms before starting work, it guards the skin against paint, grime, insoluble cutting oils and non-aqueous solvents (but should not be used against compounds which enter the circulation through the skin). Easily washed off with water when the job is done and takes all the grime with it. Costs little . . . a sound investment in employee goodwill. Write for Free Sample.

AVAILABLE without priority. Ask your jobber about the economical gallon jar . . . or the convenient 8-oz. size. E. I. du Pont de Nemours & Co. (Inc.), Dept. FM-1, Wilmington 98, Delaware.

DU PONT PRO-TEK
REG. U. S. PAT. OFF.
HAND PROTECTIVE CREAM

Nimble Fingers busily wasting time

that Multilith can save

A SYMPHONY of clattering keyboards does not necessarily mean an efficient office system at work.

In many cases—too many cases—these machines are being kept busy, writing the same characters, words, and sentences over and over—wasting time and manpower.

Wherever repetitive data is being put on paper, there, undoubtedly, is a place where Multilith master sheets can save valuable time and motion.

A wartime development which greatly extends the uses of Multilith duplicating is a new type of master sheet called a Systemat. It is revolutionizing many office methods and operations. Systemat master sheets are furnished with a business form already on them in reproducing ink. "Variable" information—to complete purchase orders, job orders, shipping documents, packing slips, instruction sheets, and scores of other forms—is then typed or written in on the Systemat which is then ready for direct Multilith reproduction of dozens, or hundreds, of accurate, permanent, black-on-white facsimiles—*every one an original.*

Multilith Duplicator, Model 1250

Multilith Models from $395 to $3725
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A cross section of Super-Cut Diamond wheels shows layer upon layer of diamonds — each individual diamond solidly bonded in a special metal alloy.

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Only Industrial Abrasives, Inc., employs the closely-guarded secret process by which Super-Cut Diamond Wheels are bonded. That is why Super-Cut wheels cut faster, last longer and materially reduce grinding costs whenever and wherever used!

Industrial Abrasives
INC.

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*Tests have proven ultra-violet one of the best and most dependable mediums for reducing absenteeism resultant from common ailments.

This Lighthouse has been created for the ultra-violet irradiation of groups of persons. It has been designed to stand upon the floor in the center of an area about twelve feet in diameter where employees can walk or stand about the lamp at an average distance of five feet. Fifteen persons can be accommodated at one time at five feet distance — the ultra-violet application involving only a few minutes.

THE LIGHTHOUSE IS STURDILY BUILT, EASY AND ECONOMICAL TO INSTALL, MAINTAIN & OPERATE

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• The growing use of electronic devices and other sensitive circuits throughout industry poses no new instrument problems for contractors or maintenance departments WESTON equipped. The familiar Model 785, with its high sensitivity and broad range scope, answers these newer measurement requirements. But more . . . it also covers most of the usual maintenance needs.

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Makers of Hack Saws, Frames, Power Saws, Band Saws, and the Clemson D-17 Lawn Machine

8884

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Time-Money-Manpower

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Please send me your Free Booklet "D-7" on solving inter-organization communication problems. And include your Survey Chart.

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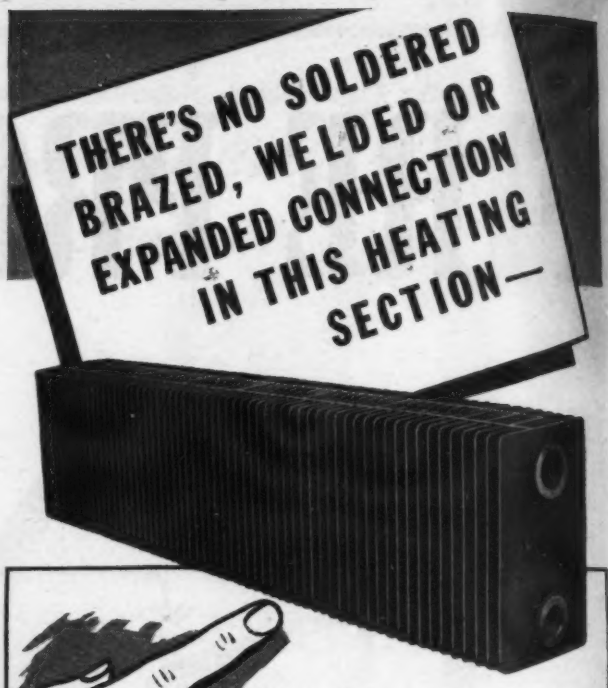
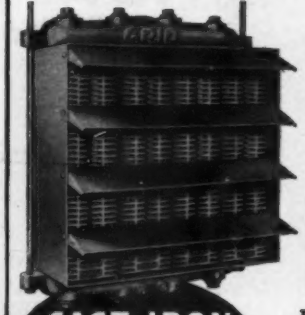


GRID condenser "fin" sections are made in one piece of high test cast iron—the same physical properties as cast iron radiators. You know how long they last! There's nothing to become loose—nothing to develop leaks or breakdowns—and being made of similar metals there's no electrolysis to cause corrosion, breakdowns or heating failures. GRID cast iron "fin" sections can also be adapted for use as radiators, both open and convector type.

GRID *has proven its merit*

ON HIGH PRESSURE • FOR 14 HEATING SEASONS WITHOUT FAILURES—



Because no other unit heater has its lasting qualities GRID units are built to last for years —to stand wear as long as the pipes furnishing steam or hot water to them. Engineered and tested to operate with either hot water or steam up to 250 lbs. pressure. So why install a unit heater that loses its efficiency after a short period when you can get GRID for permanency? Let us tell you the full story with capacity tables.

D. J. MURRAY MFG. CO.

WAUSAU, WISCONSIN *Offices in Principal Cities*

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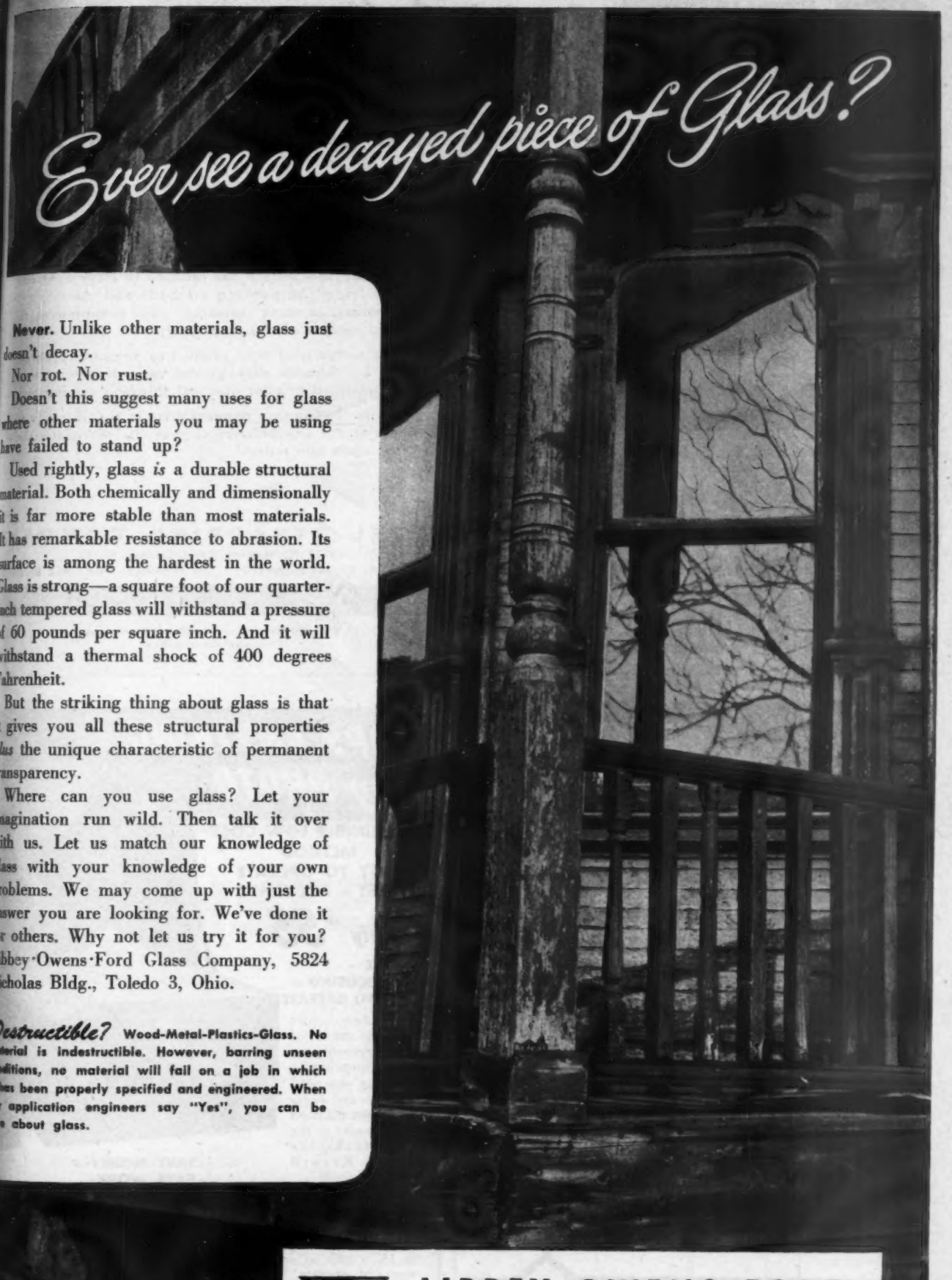

Never. Unlike other materials, glass just doesn't decay.

Nor rot. Nor rust.

Doesn't this suggest many uses for glass where other materials you may be using have failed to stand up?

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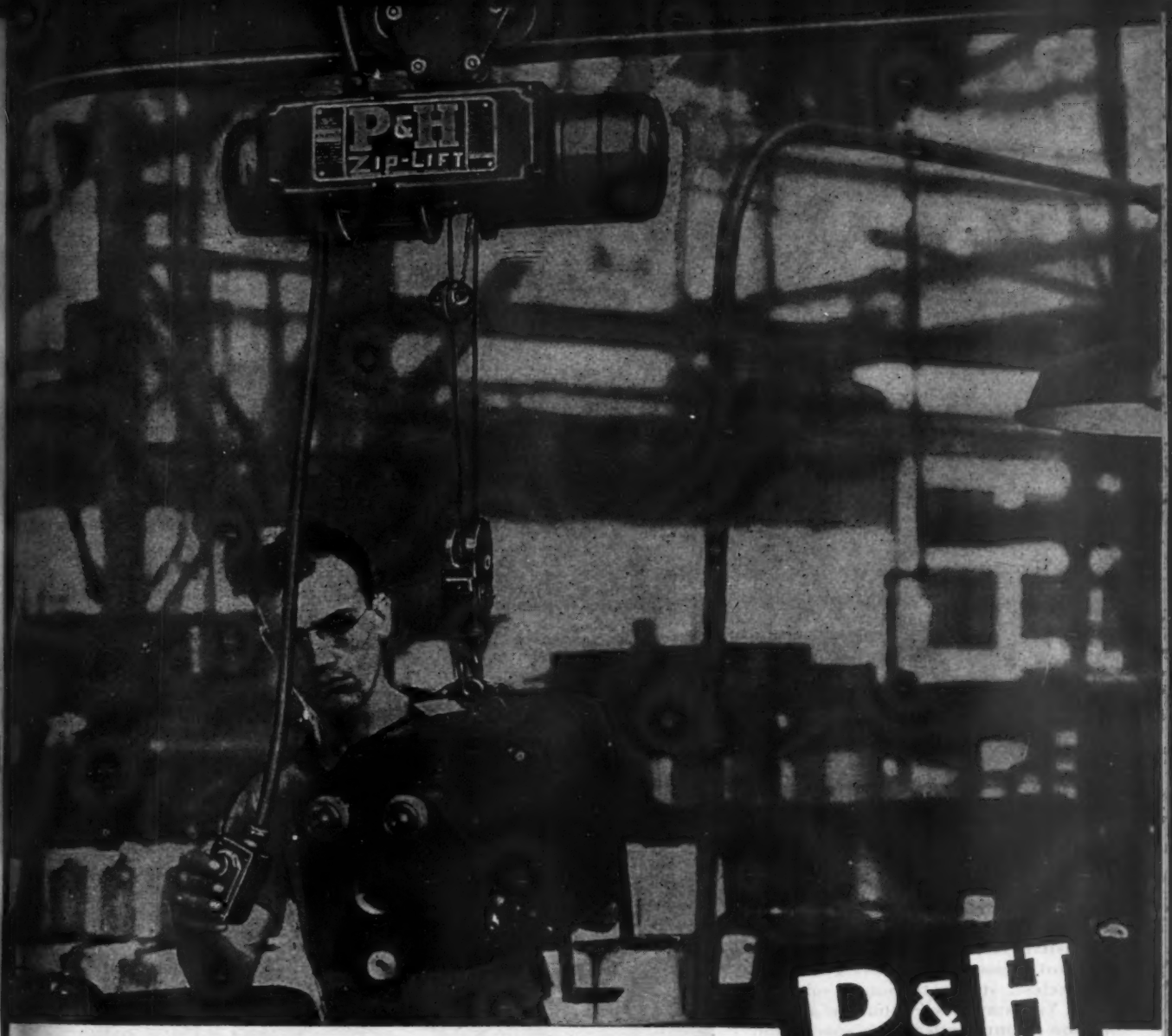

WORK *FASTER* WITH P&H ZIP-LIFT HOISTS

That's important—when war production asks more of every worker. Zip-Lifts save time for skilled hands and keep them busy on productive effort.

Zip-Lifts save effort, too—let workers be *good* workmen all day long reducing fatigue to a minimum.

But Zip-Lifts do more than that! They keep materials moving faster—putting loads exactly where they're needed—Zip-Lifts cut costs. That's important today, and will be even more important tomorrow. These small electric hoists pay for themselves twice a year on the average.

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That's why, behind all the varied types of Willson industrial goggles, there is exhaustive research, ceaseless testing, constant pressure to improve. For vision is priceless, its protection a sobering trust. You may be sure that the goggles Willson recommends for any specific job will be as right and reliable as human skill and conscience can provide.

***All* Willson protection is scientifically engineered to provide the utmost in safety and comfort. That's the reason so many Safety Directors and Purchasing Agents specify Willson for head, eye and lung protective equipment. For 73 years Willson has been a leader in the field of accident prevention.**

Willson Spectacle-Type Goggles WV4

These comfortable, attractive goggles are fitted with wide-view, super-tough lenses that surpass all Federal requirements for impact resistance and optical clarity.

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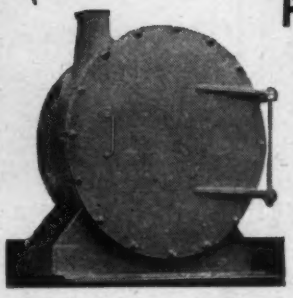
TAILOR-MADE WELDMENTS FOR INDUSTRIAL USES



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Our specialty: Unusual special-purpose jobs for heavy industry. We serve some of the nation's leaders in aircraft production, mining, petroleum, rubber, copper and brass, chemical, radio, shipping, and many other fields.

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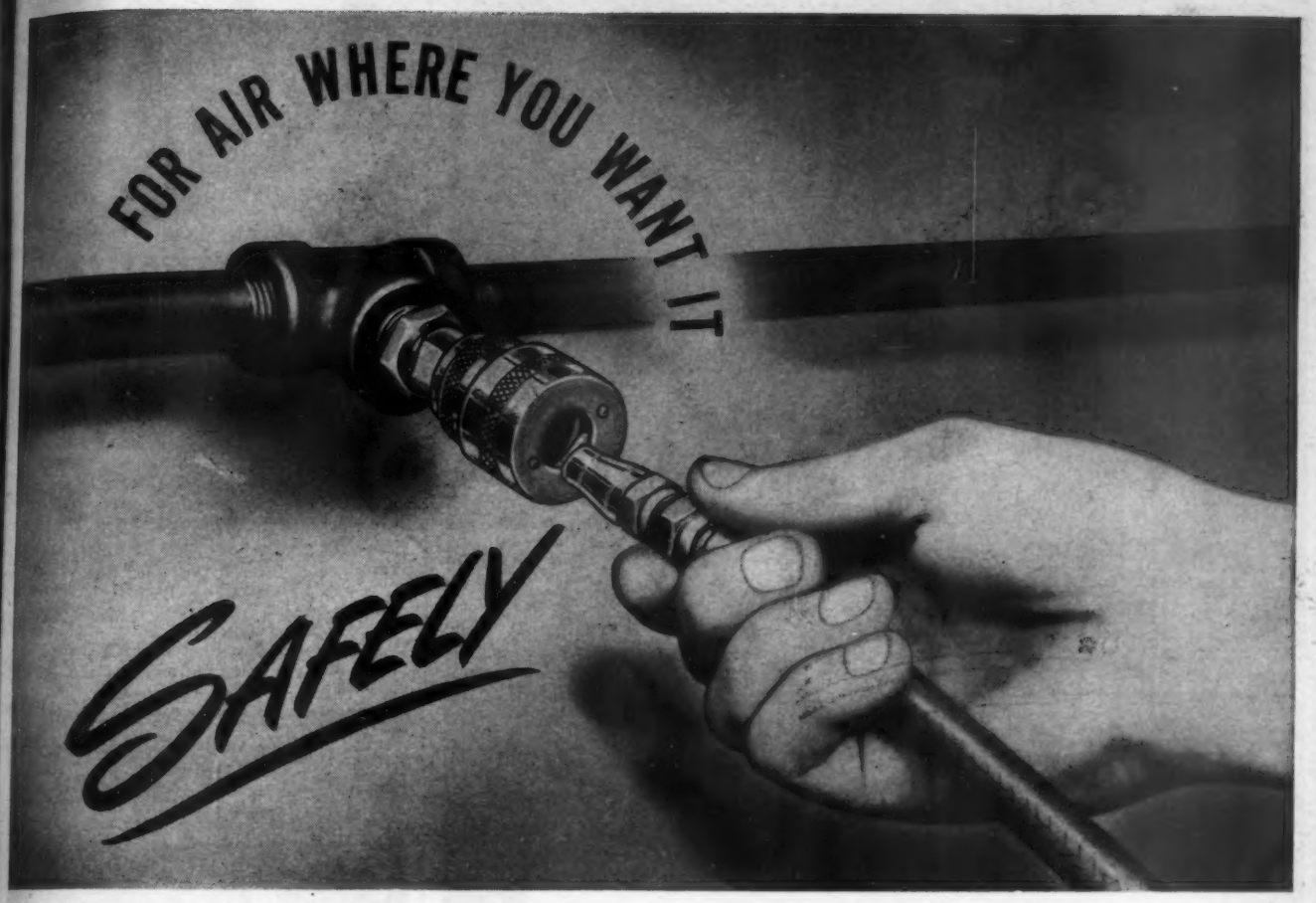

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These days you have to save steps so you certainly want the convenience of plugging in on an air line right next to the job. But when you plug in you want to be sure you stay plugged in until *you* are ready to disconnect. You don't want accidental tugging or tripping to pull out the line, waste air, interrupt work. In using sections of coupled hose, you don't want chance snagging of the coupler—on floor or work to disconnect and whip hose about dangerously.

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THIS IS the question asked by many customers . . . surprised by the wide adaptability of Bostitching in speeding production . . . from fastening fragile glass bottles onto display cards . . . to stitching heavy gas tanks. "What next!" is the question we are *all* asking ourselves as war conditions improve and new production opportunities loom in sight.

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. . . will help *you* to prepare and help *us* to plan for the revival of civilian industries. Send for details.

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Though we are tremendously busy on war contracts, a limited number of Oilers are available and we suggest you order through your Supply Jobber, now.

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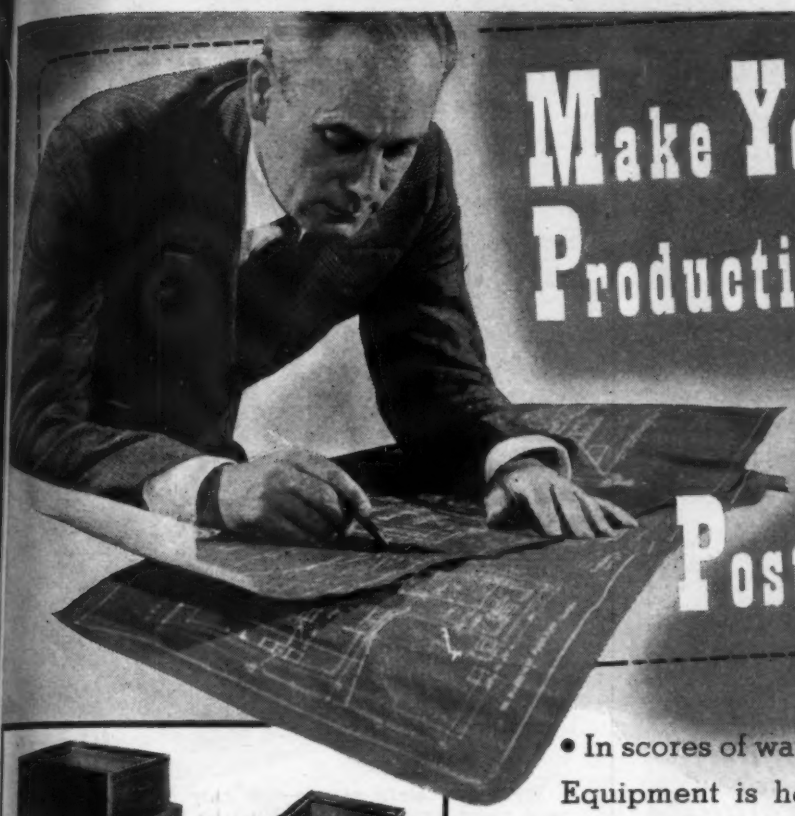

Make Your War Production Facilities *Fit* Post-War Needs

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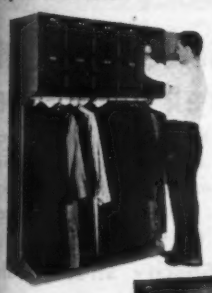
Lyon "RB" Shop Box



Lyon Shoprobe

Lyon Work Bench

Lyon Adjustable Wood Shelving

• In scores of war plants Lyon Shop and Storage Equipment is helping maintain record-breaking output . . . even in the face of overnight changes in production programs.

When victory is won . . . and quick, smooth reconversion to production of peace-time products becomes a major problem . . . this versatile Lyon Equipment will earn additional time saving, material saving, and labor-saving dividends. For all of this equipment is readily adaptable to a wide variety of production set-ups.

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Ask your Mill Supply Distributor for Catalogs showing Lyon Equipment available for prompt delivery on satisfactory priority.

LYON METAL PRODUCTS, INCORPORATED

General Offices: 212 Madison Ave., Aurora, Illinois

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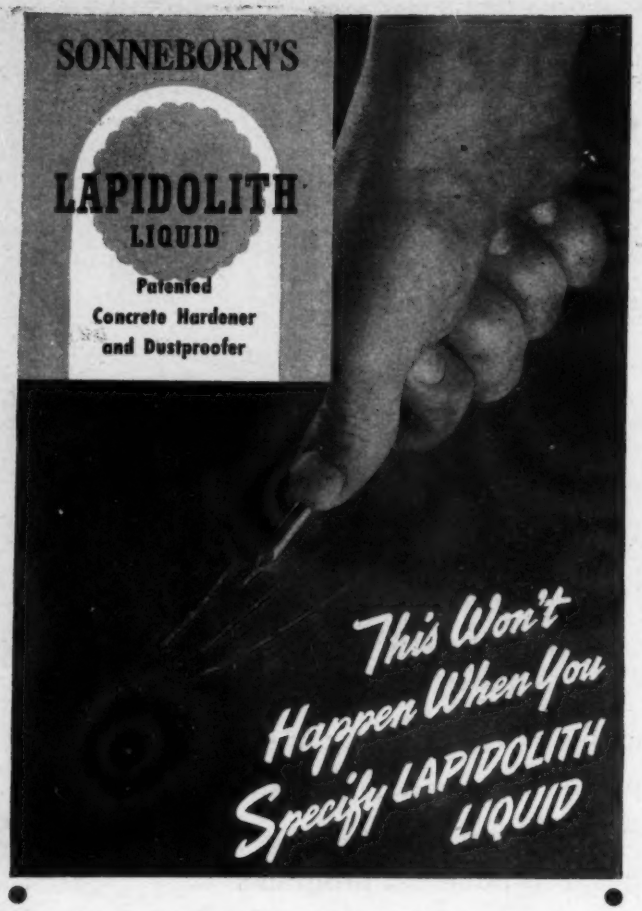

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LAPIDOLITH LIQUID is easy to apply—no wait, no delay of production or use of floors. Your own plant maintenance staff is all you need, the cost is negligible, the results permanent.

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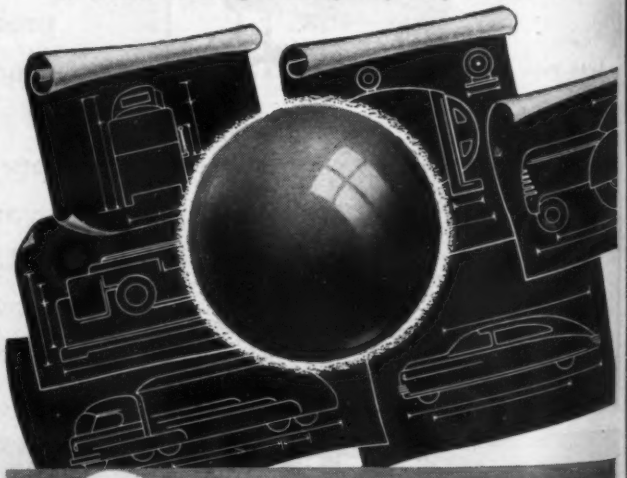
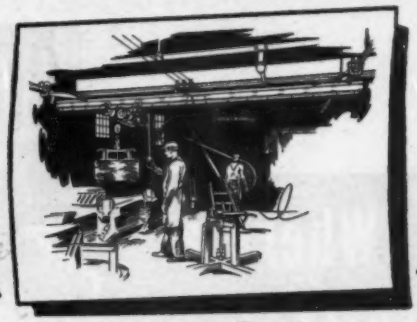
For Better Rolling Mileage Specify Strom Balls



Strom STEEL BALL CO.

1850 South 54th Avenue · Cicero, Illinois

Hand Crane with Connecting Tracks



Stripper Crane with Electric Hoist.

Spur Tracks Switch through Ovens.

Ideas for Post-War PRODUCTION

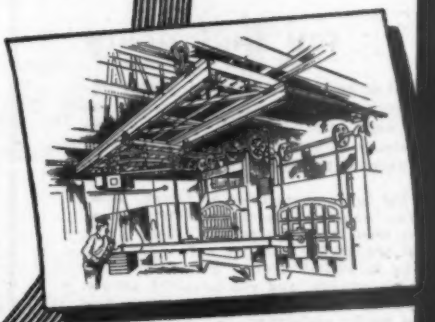
One Unit Charges Two Cupolas.

Here are several American MonoRail installations which have proven successful in low cost handling. Any plans for postwar production should include such handling methods.

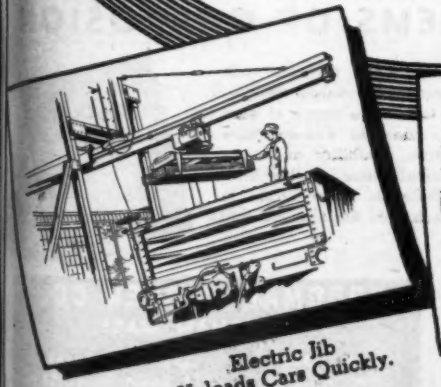
Regardless of the size or type of application, American MonoRail Engineers can help. Their specialized experience often uncovers hidden possibilities for simple systems that bring immediate returns. Consultation with these men is available without obligation. Write for copy of Bulletin C-1 showing a wide range of installations.

THE AMERICAN MONORAIL CO.

13114 ATHENS AVENUE • CLEVELAND 7, OHIO

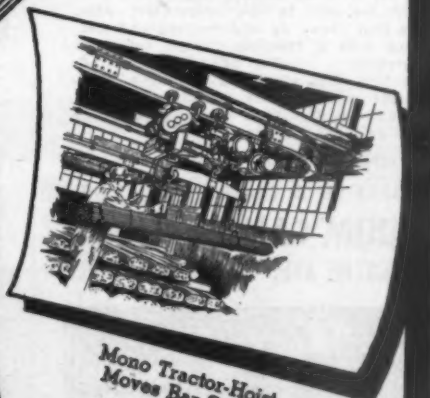


Special Crane for Fast Quench.



Electric Jib Unloads Cars Quickly.

Rigid Arm Makes Handling Easy.



Mono Tractor-Hoist Moves Bar Stock.

Here Comes the Hot Coffee!

Welcome! You can say that again

There just is no other way to service hot coffee to your workers indoors, outdoors, day shift or night shift, that will match the low cost efficiency of hot coffee service with "AerVoiD" Vacuum Insulated Coffee Carriers.

And is hot coffee appreciated by factory workers? You wouldn't ask the question if you had ever tried it. Just stop and reflect that it takes 91,300,000,000 cups of coffee per year, according to official figures, to satisfy America's coffee-craving, and you have the answer. No other beverage can point to such a pronounced public preference.

No, the "pin-up" girl in our plant is not Betty Grable, not Rosalind Russell, not Deanna Durbin, but the girl in the immaculate white uniform that shows up mid-morning and mid-afternoon with a delicious cup of hot coffee for everybody . . . office and shop. Hundreds of industrial War plants already have "AerVoiD" hot coffee service combating fatigue-lag in their workers. Cold days emphasize the need for this low-cost morale-builder.

Write for price list No. 126

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VACUUM CAN COMPANY

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"AerVoiD"
VACUUM INSULATED CARRIERS
FOR STORING, TRANSPORTING
AND SERVING **HOT COFFEE**

Where a spark means DANGER..

● Typical kit of Ampco Non-Sparking Safety Tools. This selection is used at sea by marine departments of leading oil companies.

. . . . industry relies on Ampco NON-SPARKING Safety Tools

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Don't take chances with loss of life and property, due to disastrous fires and explosions. Equip with Ampco. Over 400 standard tools — or "specials" when needed. Write today for Ampco Safety Tool Catalog.

S-1

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Dept. FM-2
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TO END ALL PROBLEMS OF CORROSION

Saran is a tough thermoplastic originally made to replace such strategic war materials as aluminum, stainless steel, nickel, copper, brass, tin and rubber. Now found adaptable to a wide range of uses in product designing, food processing and wherever non-corrosive materials are necessary. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations dealing with oils, gases, air, water and corrosive chemicals. It is available in tube, pipe, sheet, rod and molded fittings. Technical Bulletin P-8 will be sent on request. Address Dept. SJ.

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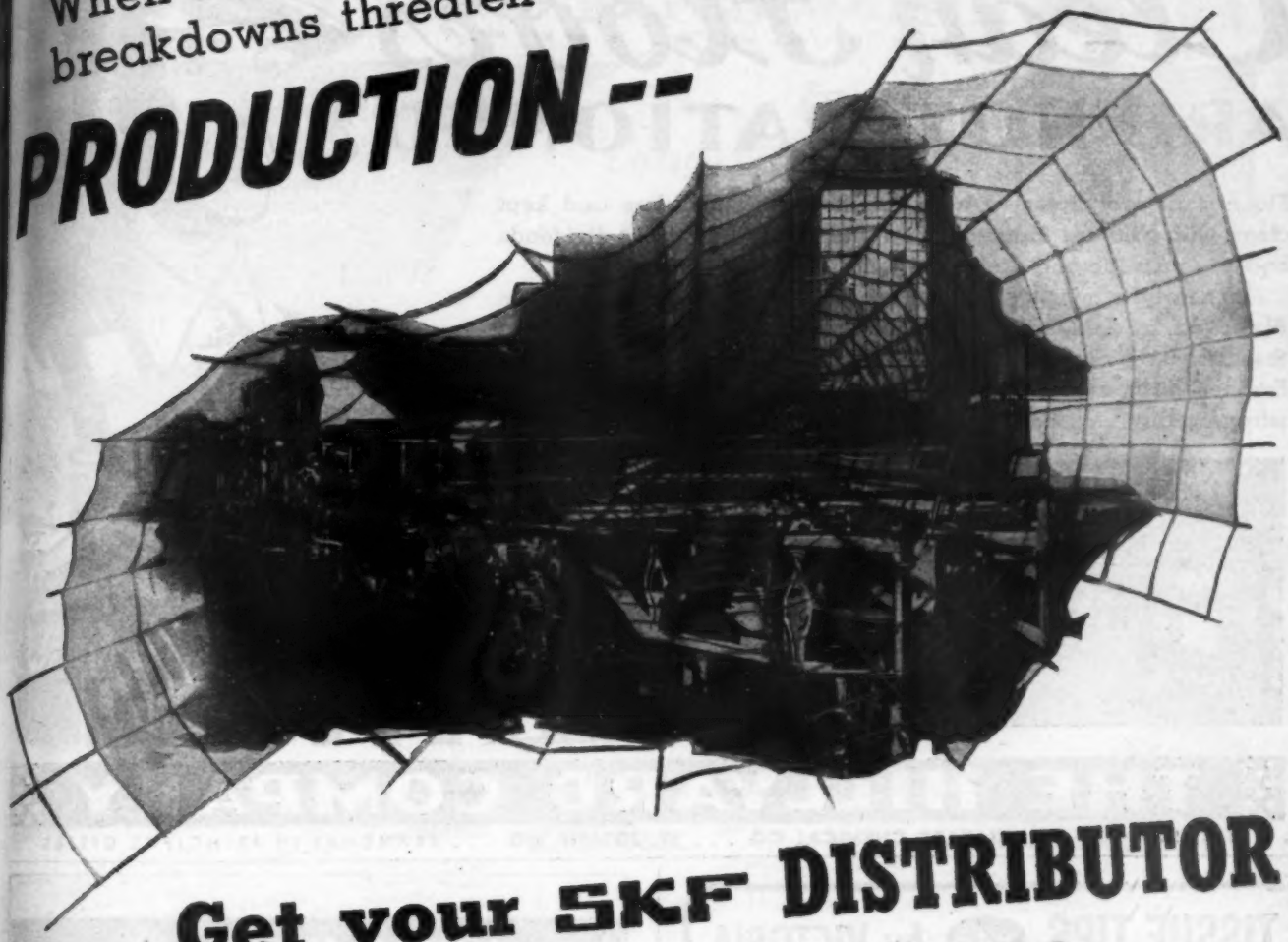
When bearing breakdowns threaten

PRODUCTION --



Get your SKF DISTRIBUTOR *FAST!*

This is no time to take chances on breakdowns of vital machinery. When bearing breakdowns mean idle machines, get in touch with your SKF Distributor . . . and let him put his specialized knowledge of bearings at your service.

Because much of SKF's capacity goes directly into Army and Navy equipment, we can't always supply the exact bearing for every job. This is no fault of your SKF Distributor . . . but he'll use his *know-how* to take up the slack.

Wherever there's a chance, he'll know how to keep wheels turning. American ingenuity can't be beaten. You'll get it from your SKF Distributor. 5454

SKF

BALL AND ROLLER BEARINGS

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Floors that are protected with Hillyard Floor Finishes and kept clean with Hillyard Maintenance Materials will pay big dividends because their life and usefulness will be extended many years.

For nearly a quarter of a Century Hillyard Products have been Approved by Leading Flooring Manufacturers and Endorsed by the Largest Flooring Contractors. Let the Hillyard Maintenance Engineer in your locality help you on any floor problem, write or wire us today . . . no obligation.

Hillyard Products are shipped in Blue Drums with white checkerboard design, trade marked and registered with U. S. Government. Each drum has a special Hillyard designed seal to protect our customers.

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INSTALL POST-WAR WIRE NOW

Rockbestos A.V.C. Power Cable below and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and a permanently insulated construction. See detail to the right.

For Long-Life in Circuits Exposed to Severe Conditions

WHY PERMANENTLY INSULATED ROCKBESTOS A.V.C. WILL GIVE YOU DURATION-PLUS SERVICE*

1 A tough, rugged, impregnated asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2 Outer impregnated asbestos wall which serves as a heat-barrier against high ambient temperatures.

3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two impregnated asbestos walls.

4 Impregnated asbestos insulation withstands the heat of overloads up to the melting point of copper and won't ignite or burn.

5 The conductor is perfectly and permanently centered in helically applied insulation.

**One of 122 different wires and cables developed for severe operating conditions.*

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(Underwriters' Type AVA)

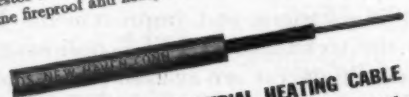
Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(Underwriters' Type AVB)

Sizes No. 18 to 4/0 AWG with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.



ROCKBESTOS INDUSTRIAL HEATING CABLE

No. 19 AWG nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.

WON'T bake brittle, burn, flow or rot.

RESISTS moisture, oil, grease and fumes.

Are you troubled with wire-failures in circuits that run around "hot-spot" locations such as furnaces, lehrs, boilers, steam tunnels, etc.? Do they seem to happen much too often? Then install Rockbestos A.V.C. *permanently insulated* wire and cable. It will not only give you freedom from wire failures for the duration, but will continue to provide trouble-free, dependable service for years to come.

Why does Rockbestos stand up? Because it has a *permanent impregnated asbestos insulation* that resists heat, flame, moisture, oil, grease and alkalies . . . and won't bake brittle, crack, bloom, rot, flow or swell. Start planning for the future as well as the present—install Rockbestos A.V.C. and forget your wire problems.

When inquiring or ordering, please furnish CMP allotment number or symbol with proper certification. For particulars and samples write nearest branch office or Rockbestos Products Corporation, 928 Nicoll Street, New Haven 4, Connecticut.

FOR VICTORY

★ ***Invest in United States War Bonds*** ★

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The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

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OF AMERICAN INDUSTRIES
ENGAGED IN WAR CONTRACTS
TO WIN THE
ARMY-NAVY "E"!
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PLANT

RUBBER & ASBESTOS WORKS

We are proud indeed to join the select few privileged to fly the Army-Navy "E" Flag.

Likewise, we are proud that Plant Precision Molded 85% Magnesia – the revolutionary product of our Emeryville factory – is saving thousands of pounds of dead weight on ships and increasing insulation-efficiency wherever installed.

Our achievement, we feel, is peculiarly American. Only co-operative effort by labor, management and capital has made possible such product-advancements and such production-performance records!

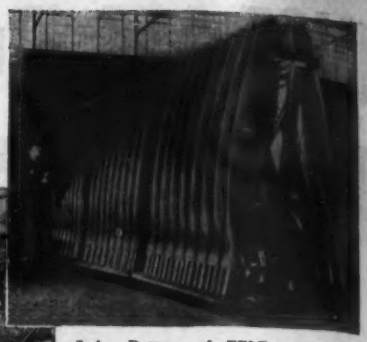
*U. S. Patents Nos. 2,121,374, 2,209,755, 2,209,753, 2,209,754.

Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

MAIN OFFICE: SAN FRANCISCO

Sales Offices in Los Angeles, Wilmington, and Oakland, distributors in principal cities • Factories in Emeryville, San Francisco, and Redwood City, Calif.

Right: View in American Propeller Corp. plant at Toledo, Ohio – FELT-polished propeller blades protected by FELT padding at top and bottom of dolly.



Left: Battery of FELT-equipped machines for precision polishing of Wideite optical lenses.

For Glass or Metals

AMERICAN POLISHING FELTS

Assure

FINER FINISH AT LESS COST!

Present trends point to a significant increase in the use of glass and gleaming metals in the buildings, decorations and utensils of our peace-time world. In the glass industry, American Polishing FELTS have long been preeminent – because of their superior performance and long-run economy. Uniform density and absorption properties account for their more efficient service and longer life span. Made extra strong to withstand the stress and strain of mounting on polishing heads, discs or wheels, American Polishing FELTS are especially processed for the most precise optical work as well as routine polishing jobs.

With metals, too, FELT polishing is now "preferred procedure". Unlike fine grinding, FELT smooths the surface without loss of excessive metal – quickly producing smooth surfaces in engine and other reciprocating parts. American Polishing FELTS are widely used for the precision finishing of aircraft propeller blades and other parts where a smooth finish is important.

Recent innovations and improvements have added much to the technique of FELT polishing both glass and metals. Engineers are available for consultation on all problems involving the use of FELT. The obligation is always ours.

American Felt Company

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NO STRAINING . . . TUGGING . . . PULLING NOR PUSHING . . .

Positive mechanical brake—controls in steering handle—forward and reverse speeds—front wheel power drive—shockless hydraulic platform lift with easy foot control.

Automatic TRANSPORTER

A trucker and a TRANSPORTER can transport the same tonnage of material a given distance that would require the physical effort of three men handling in the conventional way.

The TRANSPORTER is built in 4000- and 6000-pound capacity platform type lift trucks for skid transportation and in a pallet type fork lift truck for unit loads up to 4000 pounds on open or double-faced pallets.

Tons of bulk or packaged material is transported with the greatest of ease—and speedily too—as the trucker simply guides the load. The control of the movement of the truck is in the handle—at the trucker's finger tips—without effort he can start, stop, reverse, or increase speed.

The TRANSPORTER is designed for short hauls within the plant—it handles loads in elevators, along narrow aisles, and is valuable for use in areas where floor loads are restricted. A foot operated hydraulic lift system permits trucker to lift loads easily, even in congested places.

Get details on this modern material-handling truck that simplifies transportation and cuts costs.

MANUFACTURERS FOR OVER THIRTY FIVE YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.

39 WEST 87th STREET — DIV. OF THE YALE & TOWNE MFG. CO. — CHICAGO 20, ILLINOIS

WORK BENCHES... NOT PARK BENCHES

Last year about 700,000 men came back from the armed forces. This year it is estimated that there will be over 1,200,000.

These men will have to be classified, tested and trained. Some who are partially disabled will need special help. All will need some sort of work. That is a promise Uncle Sam has made to these boys.

Your first thought is going to be, "With the cutbacks we'll get, and our reconversion problems, our plant can't possibly re-employ many of these men." You'll be absolutely right. Right here is where we need some new terminology in our economic setup.

In my opinion, "Industry" should be defined as that portion of our economic system that creates and produces. This takes in factories, farms and mines. The word "Business" should include that portion that has to do with transporting, selling, distributing and servicing the merchandise and goods that are produced. It also includes the professions and communication.

Now, if we go into past history on that basis, we find that "Industry" has never accounted for more than approximately one-third of all of the gainfully employed people in the United States. "Business" has accounted for the other two-thirds.

Yet "Industry" will be blamed for any failure to solve the postwar employment situation. Industry simply cannot sit back and let someone else try to figure out the solution.

The job is too big for Government. Even with the best intentions in the world, Uncle Sam, sitting in Washington, doesn't know your community. This is a community job. And if it isn't done right—*you'll* be blamed for it.

Geo. D. Trundle Jr.
President

1919-1944

THE TRUNDLE ENGINEERING COMPANY

Brings to Industry

25 Years **OF MANAGEMENT ENGINEERING EXPERIENCE**

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How to make time studies

described and demonstrated in this practical manual

Here at last is a course in time study for those who do not have extended technical, mathematical, or industrial training. It starts at the very beginning and covers completely both the methods of time study and the background of machines and operations of industry the time study man must understand, in a practical, home-study treatment. The author of the book says, "Anyone who can rate 90% in answering these questions (appearing at the end of each chapter) would be able to take and hold a time study position in any industry."

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TIME STUDY ENGINEERING

By William H. Schutt

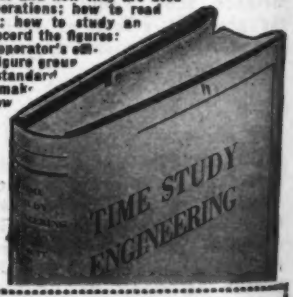
President, Detroit Time Study School, Inc.

430 pages, 6 x 9, 124 illustrations, $5.00

The book shows the whys and wherefores of time study work, reviews the arithmetic needed, tells step by step how to carry out a time study, and gives a wealth of information on the machines and processes of industry, what the time study man should know about their construction and operation, and the special factors of taking time studies on each. Twenty-eight specimen studies on specific machines and operations are shown and fully discussed in the text.

- **gives 26 time-study charts; each from an actual observation in industry**
- **describes machines and operations and their time-study factors**
- **emphasizes factors of economical production and fair standards for the worker**

Covers: Fundamentals of time study, requirements of work, equipment and how it is used, etc.; the basic motions and how they are used in analyzing operations; how to read the stop watch; how to study an operation and record the figures; how to rate the operator's efficiency; how to figure group bonus and standard hours; how to make process or flow charts, etc.



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MOTORS
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INDUSTRIAL BRAKES
BRAKE LINING

M44-6

Here is a heavy-duty motor that is built to "take a walloping" and stay right on the job. Wagner slip-ring motors when operated in conjunction with proper control equipment have these important advantages:

1 Ability to start extremely heavy loads without affecting running characteristics.

2 No abnormal heating with repeated starting and stopping.

3 Variation in starting torque to meet varying torque requirements.

4 Smooth acceleration under heavy loads.

5 Higher starting torque with lower starting current.

6 Variation in operating speed, each reduced speed adjustable for a selected rpm for a given load.

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ESTABLISHED 1891

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ELECTRICAL AND AUTOMOTIVE PRODUCTS

PUTTING THE "OK" ON YOUR REZNOR UNIT HEATER . . .

Each Reznor Unit Heater must stand inspection before shipment to you. This experienced workman, a Reznor employee for 24 years, checks over each part of the product.

Here he has connected the heater to a gas line and is applying a flame to make certain there are no leaks. In turn he will test the wiring, the valves, the controls, the pressure regulator, and all of the other parts.

When you buy a Reznor Unit Heater, you purchase a quality product that will deliver an even flow of heat where you want it, when you want it.

REZNOR

REZNOR MFG. CO.
102 James St., Mercer, Pa.

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For Longest Wear Under TOUGHEST CONDITIONS!

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ALLOY STEEL TRIPLE MAGNET **CHAINS**

T-M Steel and T-M construction are dependable for unusually long life in hardest continuous service. Today T-M Triple Magnet Chains are giving proof of their superior qualities in the severe demands of steel mills, foundries, forge shops, and many other industries.

There is a T-M chain for every purpose: Drag lines, sling chains, and other chains of surest quality for handling the heaviest loads. Your business has no chain problems we cannot solve if you will let us help you.

Send for Catalog and T-M Safe Load Charts

ARMY (E) NAVY ESTABLISHED 1873
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S. G. TAYLOR CHAIN CO.
Box 509FM Hammond, Indiana

PUTTING A NEW "HEX" ON PRODUCTION PROBLEMS

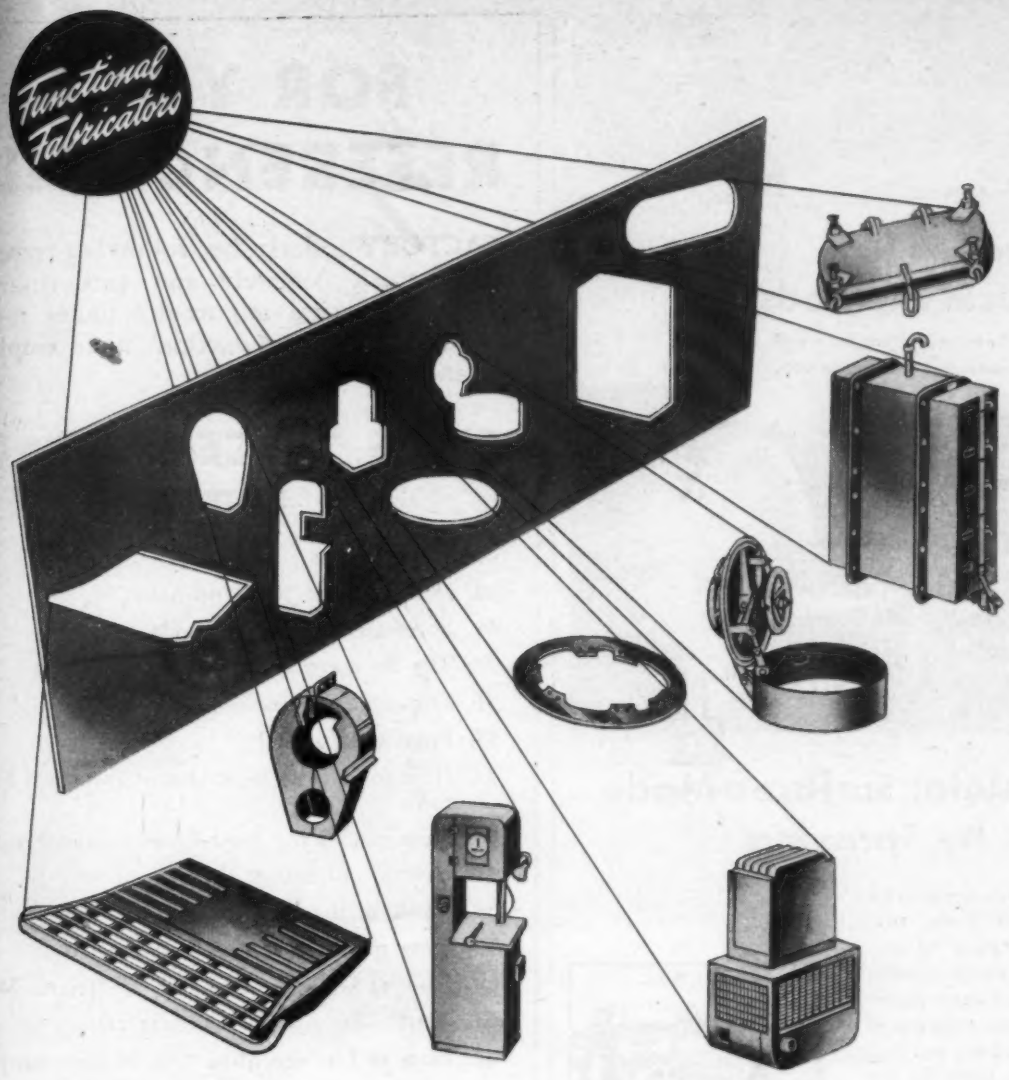
The ROL-TOP "hex" nut is a new application of the Boots principle of self-locking nuts which assure vibration-proof connections.

Because of the recognized efficiency of the ROL-TOP, design engineers are specifying it for application wherever self-locking devices are desirable.

Specially planned and built for heavy duty, the ROL-TOP Nut resists heat, air, gasoline and other destructive elements which make ordinary non-metallic devices inapplicable.

Boots one-piece, all-metal, self-locking nuts pass all government requirements.
SEND FOR CATALOGUE
BOOTS

BOOTS AIRCRAFT NUT CORPORATION ★ GENERAL OFFICES, NEW CANAAN, CONNECTICUT



To Manufacturers Not Tooled-Up For Sheet Metal Fabrication

The best guess on the new steels, white metals, plastics, and plywoods is that they will be used in combinations rather than instead of each other.

Few factories can afford to tool-up for working them all into products now or post-war.

As a manufacturer whose total sales have passed well beyond the $100,000,000.00 mark, we have found that certain parts of the many steel products we manufacture can be made in other factories more economically than were we to tool-up for it.

On the other hand we have demonstrated to a number of other manufacturers that we can produce the sheet metal parts for their products speedily, better and more economically. Even before wartime no small portion of our facilities was devoted to functional fabrication for other manufacturers.

The Butler organization can place at your service:

43 years of know-how.
High aptitude engineering.
Skilled metal crafters.
Three great factories.
Hundreds of sheet metal working machines.
Line production methods.

If you are interested in the plus value and minus costs this affords, send your specifications to Butler Engineers at our Kansas City factory, 1221 Eastern Ave.

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PRODUCING FOR WAR... PLANNING FOR PEACE

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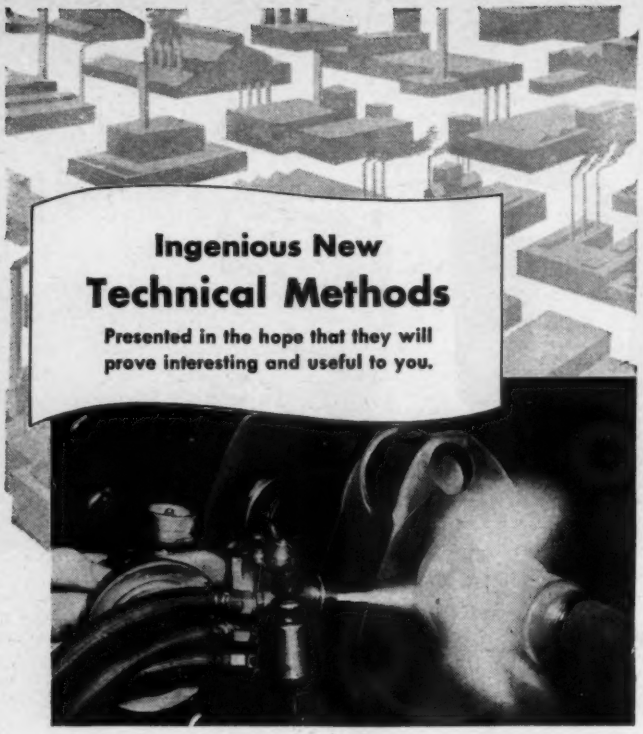
RURAL GAS SYSTEMS ... SEPTIC TANKS ... GRAIN BINS ... FARM EQUIPMENT and PRODUCTS OF OTHER METALS



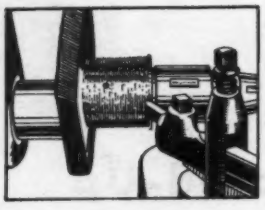
Ingenious New

Technical Methods

Presented in the hope that they will prove interesting and useful to you.

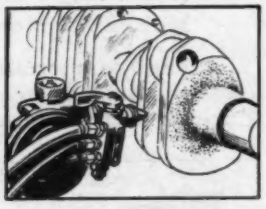
New Metal Surfaces Made by Spraying

Molten metal is now sprayed or atomized on to metal surfaces for the purpose of salvaging worn bearings, shafts, cylinder walls and such parts. Metallizing, as the process is called, is also used for putting a non-corrosive coating on iron or steel surfaces subject to corrosion such as cylinder walls of internal combustion engines, valve gates and such parts in contact with water. The metals to be sprayed may be aluminum, zinc, stainless steel, high carbon steel or other alloys depending upon the character of the surface desired. The sprayed surface may be "over built" and machined down to size to obtain accurate surfaces.



Rough threading—cooling locks metal firmly to surface, producing a permanently tight bond.

Metal spraying guns have been perfected for use with various types of gases for heat, depending upon the melting temperature of the metal to be sprayed.



Sprayed journal before finishing—Main bearing journal after surface has been Metallized.

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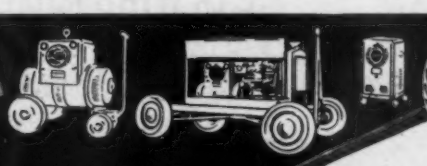

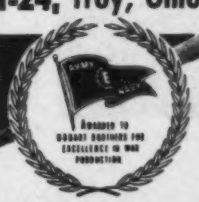

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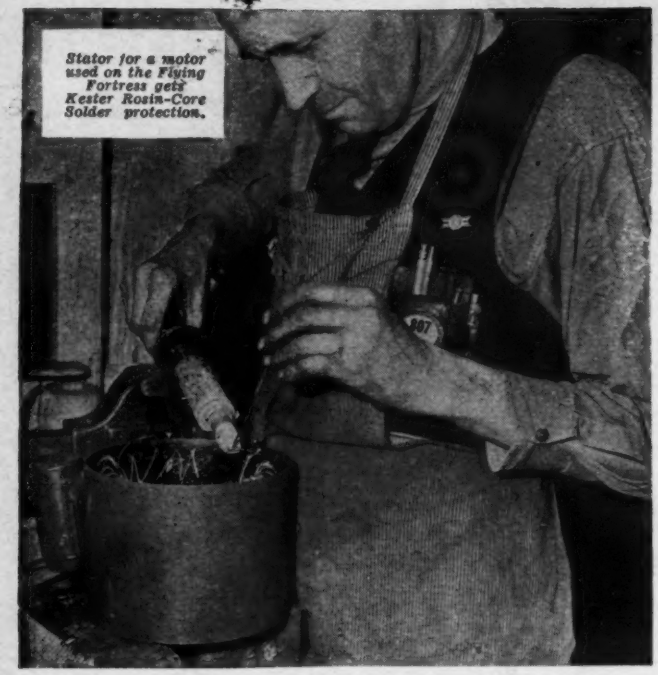

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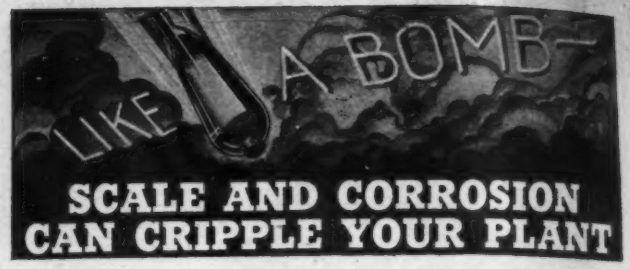

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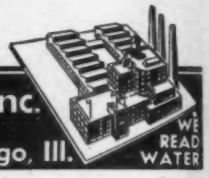

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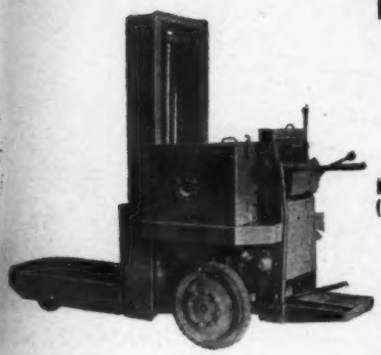
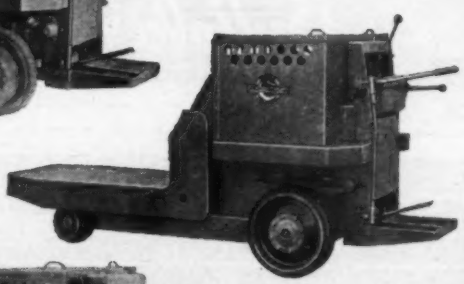


NCRE—High Lift or Tiering Truck. (4,000 and 6,000 lbs. capacity.)



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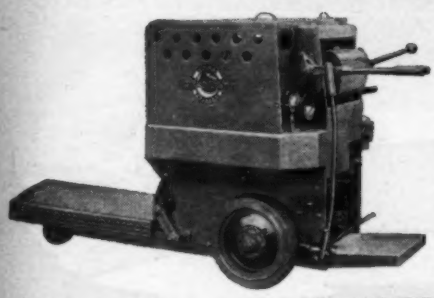

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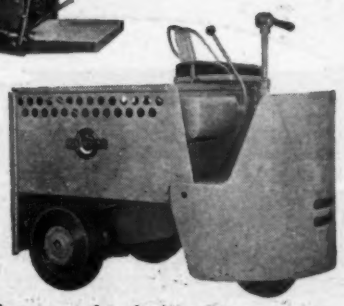

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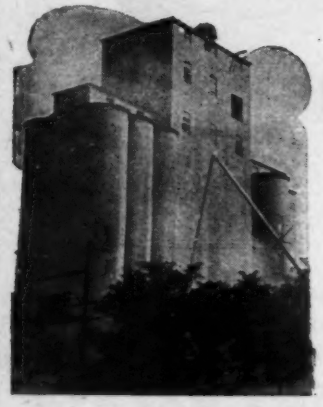

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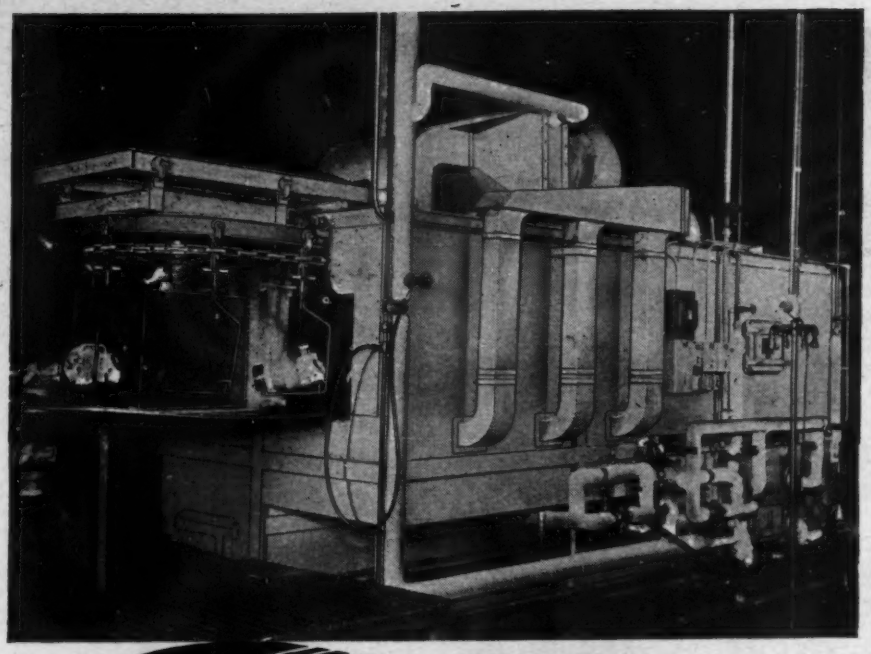

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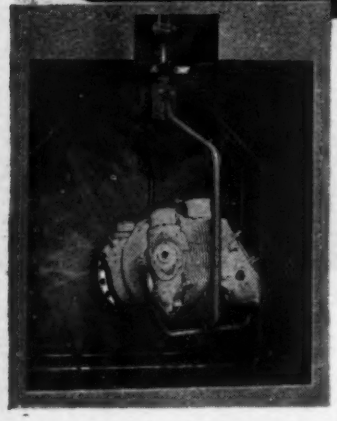

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MARKS THE SPOT

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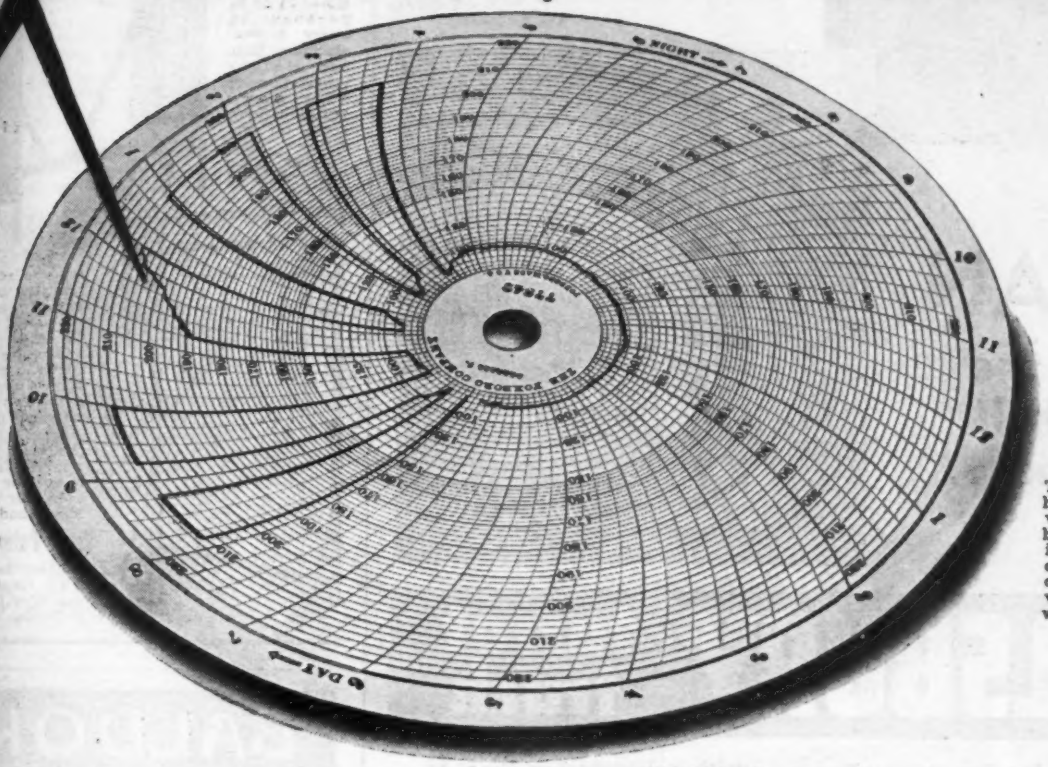

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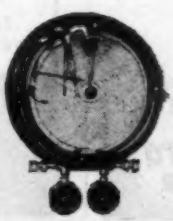

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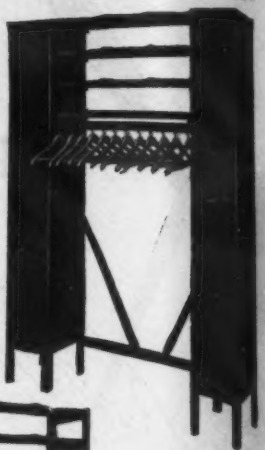

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Ideal for drill press operators, assembly line workers, inspectors, etc. Adjustable, washable, smartly styled to protect all vital parts of the head, stays comfortably, firmly in place. In 4 inexpensive styles.

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Ask about our Women's Work Clothes.

No. 400
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20 East Jackson Blvd. Chicago, 4, Ill.

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Model AR

Today more plants than ever are using Redington Counters as "watchdogs of production." Installed on conveyor lines, screw machines, punch presses and other equipment, these counters tell at a glance whether output is lagging . . . they help know costs . . . prevent shop squabbles on production figures. Models for many types of machines. Write for details.

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...USE UNITCASTINGS!

● Built to blast its way through hell and high water in landing operations...Uncle Sam's amphibian tractors are another of this war's important new weapons.

Some of the fittings for these rugged tractors are alloy steel castings produced by Unitcast! Shown here are Unitcastings for the bogie or suspension arms. Other steel castings, used in the propelling mechanism, are also produced here at Unitcast.

Today at Unitcast—to meet demands for castings of highest quality and dependability...the entire facilities are producing many vital parts that are the guts of mechanized fighting units! In tomorrow's peacetimes...there'll be "battle-proved" Unitcastings for a wide range of better products! Unitcast Corp., Toledo, Ohio.

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ALLOY AND CARBON ELECTRIC STEEL CASTINGS

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VALDURA SINGLEKOTE

THE 1 COAT OIL PAINT FOR ALL INTERIOR SURFACES

YOU'LL USE LESS

LABOR. Singlekote primes as it seals as it finishes—one painting operation, not three.

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and Get More

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Bright, cheerful walls step up efficiency, employee morale, reduce accidents.

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High light reflectivity of Singlekote will increase illumination up to 65%.

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Valdura Singlekote covers and hides up to 750 square feet per gallon, depending on the surface.

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AMERICAN-MARIETTA COMPANY
Executive Offices
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Plants at Kankakee, Marietta, High Point, Cleveland

SEE BETTER WITH GREATER *Safety*

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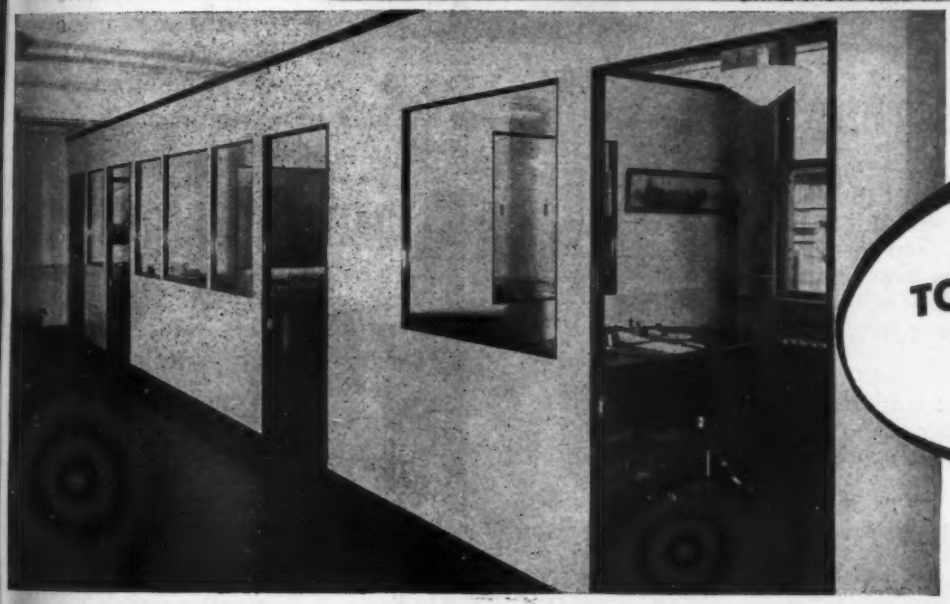

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WHEN extra offices are needed during wartime, they are usually needed in a hurry. And J-M Movable Transite Walls make them available practically overnight.

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PLUGS UP CRACKS • MAKES PACKING OR GASKETS • CAULKS CASEMENTS
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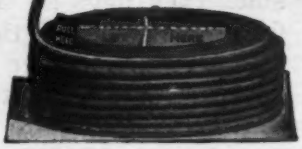

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About 80 ft. to a roll. Order through your supply house or $1.25 postpaid.

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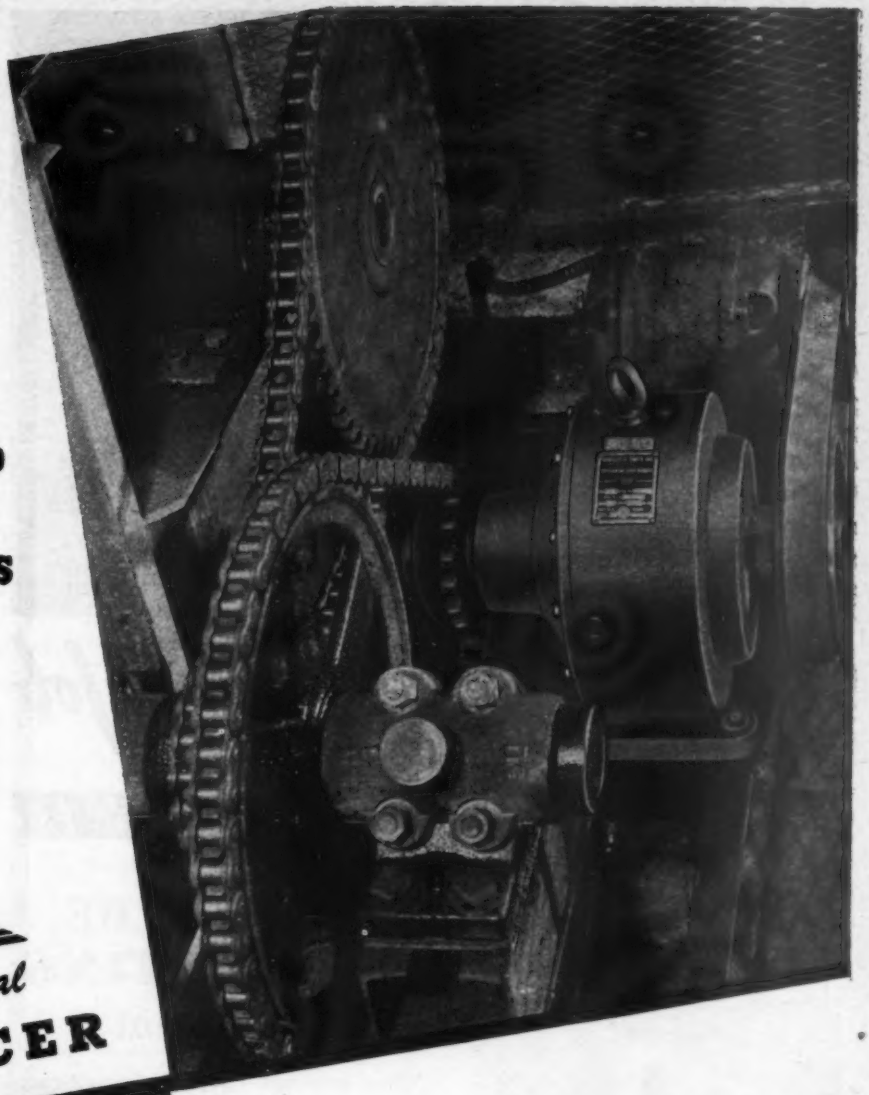

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★ Light weight, perfect balance, enable operators to work longer hours at top speed.

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Paasche Automatic Airpainting Units speed coating of shell cases. One of hundreds of applications.

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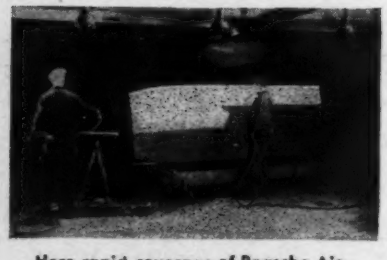
When you put Paasche Airpainting Equipment on the job, you save mighty minutes. Work that required tedious hours is done in a fraction of the time — and Victory speeded.

The illustrations at the left show only a few of the jobs on which Paasche Airpainting Equipment steps up production — saves man-hours — improves quality. Proof of this is evidenced in hundreds of factories — in shipyards — in aircraft plants — and on those big construction painting jobs.

Investigate Paasche time-saving Automatic Units — safer, cleaner Water Wash Booths — the High Production Airbrush illustrated — and other equipment for faster finishing.

Write for full information and literature. Paasche Airbrush Co. 1944 Diversey Parkway, Chicago 14, Illinois.

Paasche Airbrushes speed painting of ships, boats, marine parts.



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Manual, automatic and special airpainting equipment, airfinishing booths, pressure regulators, airconditioners for compressed air lines, air dusters and stripers.

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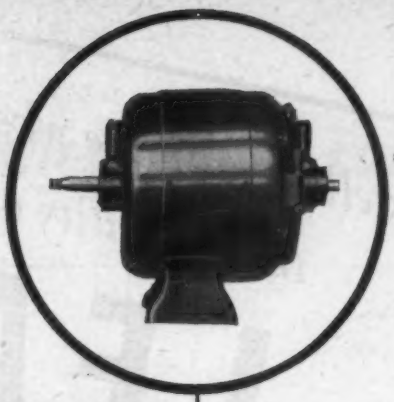

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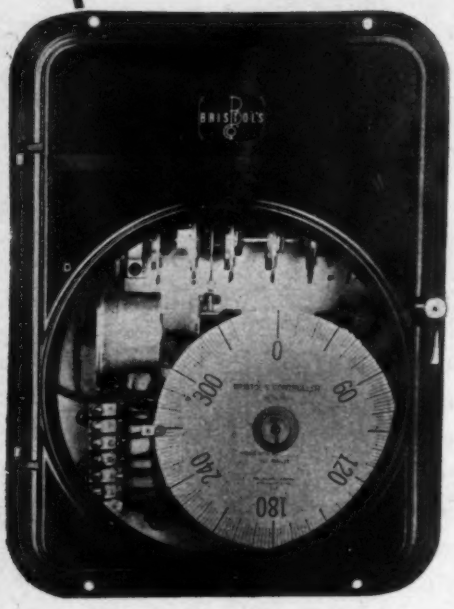

The Bristol Company, Waterbury, Connecticut, a leading instrument manufacturer, finds numerous uses for LEA Methods and LEA Materials for burring and finishing. As the manufacturers put it, "while our product is so specialized that it does not readily lend itself to production line methods, LEA Methods and Materials are used on many small parts and assemblies that need polishing or burring. The most extensive use is made in preparing parts for plating."

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The NON-SLIP, HARD-WEARING, FIRE-RETARDENT FLOOR AND DECK COATINGS, AND PAINTS

. . . adaptable to stairs, ramps, floors, decks and areas around machinery, etc.

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For BONDING, JOINING, FASTENING GLASS · WOOD · METALS · CORK · FIBRE · CONCRETE · CERAMICS · RIGID PLASTICS, ETC.

without nails, screws, bolts, shields or clips.

SUCCESSOR TO WET MORTAR FOR TILE SETTING

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1. Send Felters a brief description and weight of the machine, measurements of the base or feet.

2. Felters will send by return mail, Unisorb pads of the proper density and size.

3. Cover both sides of Unisorb Felt pads with Eagle Brand Cement and that's all there is to it.

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4 Place Unisorb Felt over floor pattern, set machine on floor.

No Bolts . . . No Seams No Damage to Floors

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The Unisorb method saves time, money, floors—cuts down machine vibration, reduces wear and repair, noise and fatigue—improves output in quality and quantity.

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C-D/Fog blankets fire with an icy covering of carbon dioxide. It seals out air and snuffs out flame. It is swift. It is safe. It is efficient.

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(Illustrated)

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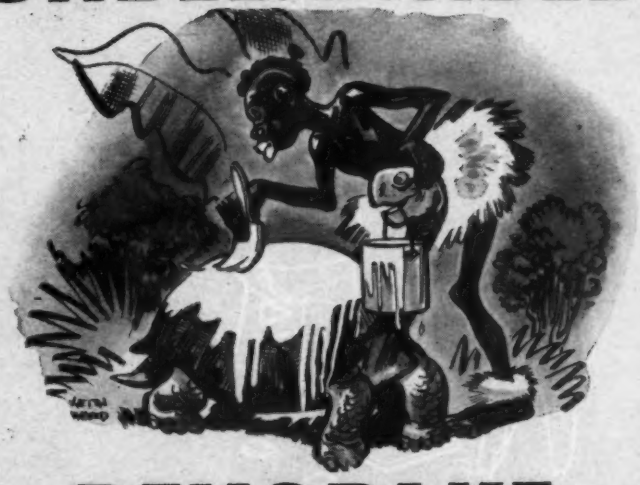

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This book deals with accidents and near-accidents as *cases*, and sets forth a method of handling these cases that is practicable, tried, and proved. It includes a wealth of practical knowledge—the methods discussed are those which have been tried in the field and proved successful, providing the kind of workable material that can be applied to the problems which confront you under actual operating conditions.

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WRITE FOR BULLETIN F. M.
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...wherever help is needed you can count on

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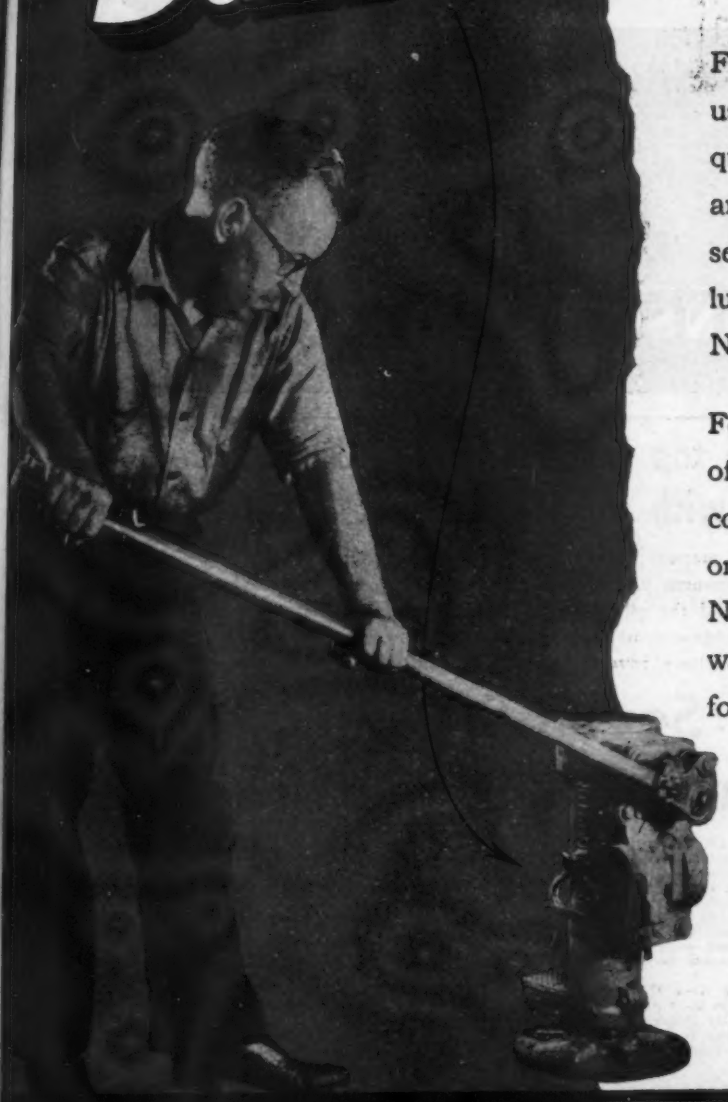

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POSITIVE ACTION

SLOW SPEEDS

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ONLY TWO MOVING PARTS

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SIZES *for* EVERY PLANT REQUIREMENT

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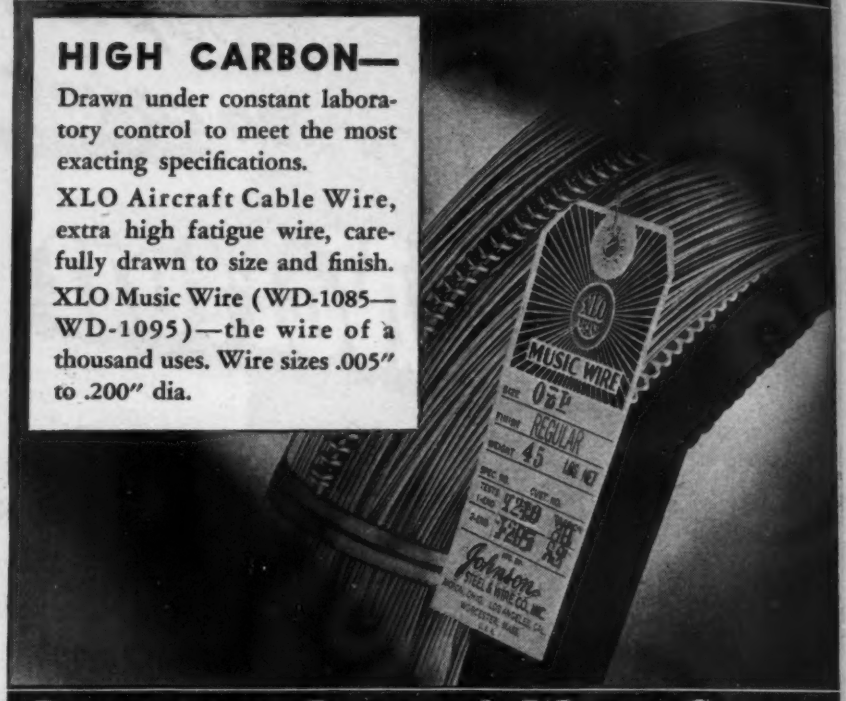

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Even though your office is operating on a relatively efficient basis, the application of the plan outlined in this book can save an average of one-third of the paper used and permit the reassignment of as much as 25 percent of clerical time.

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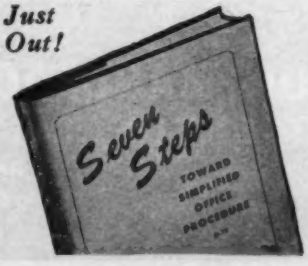

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BECAUSE your roof doesn't leak, don't take it for granted that it is not heading for trouble. J-M Roof Survey reports reveal many roofs with torn flashings, dried-out roofing felts, even rotted decks . . . yet because they hadn't started to leak, they were assumed to be in "good condition."

The Johns-Manville Roof Survey plan offers you an easy way to get the facts about your roof and these facts may save you an expensive repair bill later on.

The report will tell you the condition of all the critical areas . . . flashings, deck, roofing felts, parapet walls, skylights, etc. It will also give you a permanent record for reference so that you can plan ahead for any maintenance work which may be needed in the future. Why not inquire about this J-M service? There is no obligation.

Ask for this free Roofing Book

Based on over 85 years' experience with roofing problems of all kinds, Johns-Manville has published an interesting booklet entitled "Things You Should Know About Your Roof." It discusses all the critical areas and is liberally illustrated with easily understood diagrams. It includes a complete description of J-M Asbestos Built-Up Roofs which are well known for their fireproof, rotproof and lasting qualities. For a free copy, mail the coupon.

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Gentlemen:

Please mail me a free copy of your book "Things You Should Know About Your Roof."

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FLOORS that help EMPLOYEES SEE BETTER

One of many advantages of Light-Reflecting Floors made with Atlas White Cement

That floors, like walls and ceilings, can be made effective reflectors of light and thus improve seeing conditions, is a development of war-plant construction. And when made with Atlas White cement, their reflective properties are more than skin deep.

Light-reflecting floors made with Atlas White cement have already proved their contribution to overall lighting effectiveness. In a large airplane plant, a *white* cement floor increased lighting on vertical work areas by 20%—underwing areas by 61%—when compared with a *gray* cement floor. Compared with darker floors, the difference would be greater still.

For the full story of light-reflecting floors, ask for a copy of "Light From Floors." Write to Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary) Chrysler Building, New York 17, N. Y.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

P-F-25

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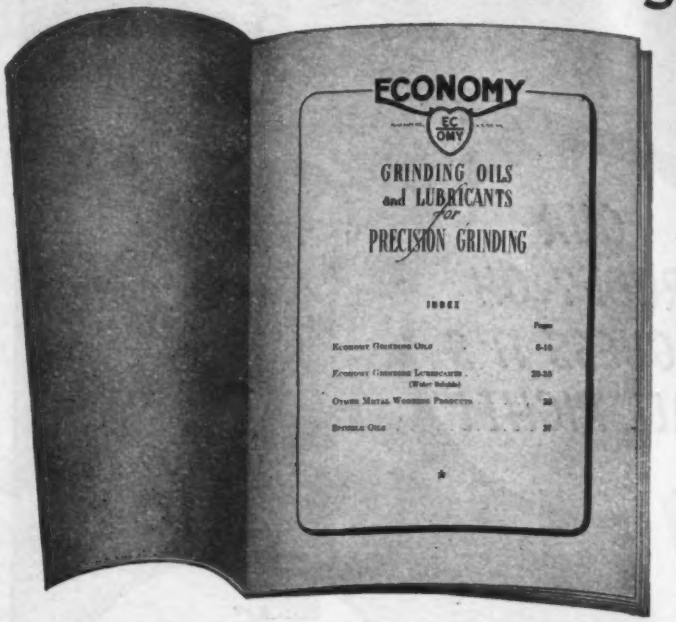
For Light-Reflecting Floors

Yours for the Asking



This book—contains valuable information—illustrations and carefully prepared text on speed and precision in grinding made possible through the use of ECONOMY GRINDING OILS AND LUBRICANTS. Simply ask for catalog 1944-F-22.

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REVOLVATOR PORTABLE ELEVATORS and RED GIANT LIFTRUCKS

Telescopic models lift to any practical height for servicing high ceilings; collapse to pass under low doorways. Revolvable base for faster piling and operation in narrow aisles.

Don't try to meet today's abnormal needs and tomorrow's keen competition with yesterday's material handling equipment. REVOLVATOR Portable Elevators and Red Giant Liftrucks have enabled many prominent users to move and pile more goods in less time with fewer men and utilize all storage space. There's a type of each to fit your needs.

Red Giant Liftrucks in single, double and multiple stroke hydraulic. Capacities up to 15,000 lbs. Non-kicking handle. Front and side lift.

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DESIGNERS AND MANUFACTURERS OF MATERIAL HANDLING EQUIPMENT

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Featuring additional products and specialties for manufacturing plants

FLOOR RESURFACING REPAIRING
READY-MIXED MATERIALS
ROCK-TRED comes factory prepared. Nothing else to add. Trowel it over concrete, wood, brick and other types of floors. It's spark-proof, load-proof, non-slip and fire-safe. Lasts a lifetime.
SPEED PATCH is also ready-mixed. Provides patches that can be used without delay. Simply fill broken areas with Speed Patch, tamp solid and truck heavy loads over them immediately.
ASK about our conductive, explosion-safe floors, Kover-Oil sealer, roofing materials, caulking compounds and other maintenance products.
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"ANGLE-SET-MAGNET-BLOCK"
$25.00 *Complete* For Magnetic Chuck Grinding. Keep Surface grinder wheels in good order. A boon to tool and die makers. Comprises 3 units: Block — 2½x3x1, 12° "Angle-Set" and BIG-HED-NIB with No. 10-CNX Diamond Rotate top nib only to sharpen.
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FEATURE ON "WELD-BILT" PLATFORM TRUCKS
Saves: Time—Labor—Men—Floors — Product Damage
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Costs — Management — Inspections
Research — Accounting — Motion Studies

Consulting Services on Plant Management Problems

ASSOCIATED ENGINEERS, INC.
Management—Consultants
Engineering—Accounting
Organization—Methods—Costs
Old First Bank Building, Fort Wayne, Indiana

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INCENTIVE PLANS JOB EVALUATION
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"By reason of special training, wide experience and tested ability, coupled with professional integrity, the consulting engineer brings to his client detached engineering and economic advice that rises above local limitations and encompasses the availability of all modern developments in the fields where he practices as an expert. His services, which do not replace but supplement and broaden those of regularly employed personnel, are justified on the ground that he saves his client more than he costs him."

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Training in Work Simplification
330 W. 42nd Street
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BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
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The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. F.M.M.

NEW ADVERTISEMENTS received by 10 A. M. February 18th will appear in the March issue, subject to limitation of space available.

WANTED

Methods and Standards Engineer

For position as assistant in Methods and Standards Department of large midwest food processor.

Position requires

Experience in Bedeaux Incentive Plan
Experience in Job Methods Analysis
Engineering training

Position offers

Opportunity for advancement
Excellent post-war possibilities
Salary (starting) approx. $4,000.00

P-681, Factory Management & Maintenance
520 North Michigan Ave., Chicago 11, Ill.

POSITIONS VACANT

INDUSTRIAL ENGINEER — Old established company now reconverting to pre-war production (essential products) has opening for graduate industrial or mechanical engineer who is interested in following time study, motion time anaylsis, job evaluation, and general industrial engineering work as a profession. Experience desirable but not essential. If employed in war industry, statement of availability required. Give complete details of personal qualifications and work history in letter of application to P-665, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

MASTER MECHANICS, Plant Engineers, Mechanical Superintendents, Draftsmen and Electricians for textile, pulp and paper mills. Charles P. Raymond Service, Inc., 294 Washington St., Boston, Mass.

FIRE PROTECTION ENGINEER and Inspector. Permanent positions open in East, South, or Middle West, with large industrial fire insurance organization. Previous knowledge in this work not necessary. Applicant must be a technical graduate with manufacturing or engineering experience, and possess a good personality. Send photo with letter. Men subject to draft for military service cannot be considered. P-683, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

MANAGEMENT CONSULTANT wanted to associate with established consulting mechanical engineers covering central south. Engineering training not essential. Experience in consulting field very desirable. Ability to get business from large and fertile list of interested prospects, necessary. Full partnership without investment. Graves Engineering Co., 3rd National Bank Bldg., Nashville 3, Tenn.

POSITIONS WANTED

INDUSTRIAL ENGINEER qualified to act as Plant Manager Assistant Plant Manager, Chief Industrial Engineer — 22 years experience job evaluation, methods improvement, cost control, budgets, standards, factory layout, incentives, foreman training, industrial relations, supervision. Protestant. Employed. PW-658, Factory Management & Maintenance, 68 Post Street, San Francisco 4, Cal.

(Continued on page 426)

INDUSTRIAL RELATIONS DIRECTOR

now employed, experienced in dealing with male and female, white and colored help, in constant contact with various government departments; legal education and special training in personnel work; seeks greater opportunity; location unimportant. Write P. O. Box 107, Louisville, Ky.

WANTED
PLANT SUPERINTENDENT

Pacific Northwest Centrifugal and Turbine Pump Manufacturer, in business 20 years, is now making plans for current and postwar production. Needs a plant superintendent with the following qualifications:

1. Thorough knowledge of the machinist craft and of the equipment used by machinists
2. A minimum of five years experience involving supervision of a number of people
3. A background of experience in planning and organizing the daily work of men, machines and materials
4. Although experience in the pump industry desired, this is not requisite.
5. Ingenuity in development of fixtures and machine set-up to reduce manufacturing time to a minimum is of major importance.
6. Most important is ability to direct and lead men
7. Fundamental training in supervision such as given by Training-Within-Industry Division of War Manpower Commission, Job Instruction Training, Job Methods Training, Job Relations Training, Safety Engineering, National Foreman Institute, etc.

This company is willing to pay in proportion to the individual's ability to do this job. At present this company is considered 100% essential in War Production. This is an opportunity for the right individual to assure his postwar future.

Send history of experience and photograph to
P-695, Factory Management & Maintenance,
68 Post St., San Francisco 4, Calif.

WANTED
ASSISTANT PLANT MANAGER

A mid-western manufacturing company, established over 60 years and one of the leaders in its field, wants an assistant plant manager between 40 and 45 years old with practical and engineering education. Experience in fabrication of sheet metal products is desirable but not absolutely necessary. The position is permanent and has an excellent post-war future. Give complete background, details of experience and salary expected. All letters will be kept confidential.

P-675, Factory Management & Maintenance
520 North Michigan Ave., Chicago 11, Ill.

WE'RE SEEKING

JUST THE RIGHT MAN TO HIRE AS

SUPERINTENDENT

One of the leading and long established small arms manufacturers of America wants a plant superintendent of outstanding ability. We are looking for a man who will strengthen our organization and play a major part in our post-war operation for which we contemplate a permanent personnel of approximately one thousand workers. Our plant is located in New England.

The man we want must have the experience, background, and proved ability for this highly important position, for which we will gladly pay an ample and commensurate salary.

In applying, state in detail your experiences, education, age, condition of health and other points we ought to know about you. Please include references and, if convenient, your photograph. All applications will be considered as strictly confidential. APPLY BY LETTER ONLY.

P-680, Factory Management & Maint., 330 W. 42nd St., New York 18, N. Y.

WANTED

ELECTRICAL ENGINEER

Excellent postwar opportunities, with old established firm, for electrical engineer with knowledge of electrical heating element design and application. Give full data as to age, education and experience in first letter.

P-694, Factory Mgt. & Maintenance
330 West 42nd St., New York 18, N. Y.

WANTED

MECHANICAL ENGINEERS

Vegetable oil processing plant in Southwest wants a young experienced Mechanical Engineer to supervise mechanical service departments, and another to do engineering development and design.

P-693, Factory Manage. & Maint.
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

ESTIMATOR

For steel stampings plant. Man with experience in figuring costs for light and heavy stampings. A permanent position for the right person, with excellent opportunity for advancement. Applicant must comply with WMPCES. State Draft Status, age, experience and salary expected. Replies will be acknowledged.

P-676, Factory Mgt. & Maintenance
520 N. Michigan Ave., Chicago 11, Ill.

Present and Post-War Opportunity for Executives

• You can grow big in this rapidly expanding business which has spectacular prospects, if you can bring talent and experience for any of these executive positions - -

★ Tool Engineer
★ Process Engineer
★ Inspector
★ Production Supervisor

• Our location is in Michigan. Our products are diversified with no seasonal or depression slumps. We work in metal. We sell nationally. We're young, experienced, ambitious and hope you are, too. • Write in strict confidence regarding experience, availability, draft status and personal qualifications. Salary open.

P-677, Factory Mgt. & Maintenance
520 No. Michigan Ave., Chicago 11, Ill.

WE NEED

An Exceptional Man As

FACTORY MANAGER

A 45-year-old manufacturer of special metal-working machinery has an opening for a man to take complete charge of factory operations.

WHAT WE OFFER —

A chance for you to become a member of the staff of a medium-sized designer and builder of special machinery. The plant is in Detroit, which means you'll have to live there. This is a permanent position with excellent post-war opportunities. You'll work in a congenial atmosphere with men who are recognized leaders in their field. You'll be really busy, and you'll have substantial responsibilities. But you'll have a secure position with a responsible and respected firm. You'll have no financial worries, because we're prepared to pay a salary that's commensurate with the importance of the job.

WHAT YOU WILL HAVE TO OFFER US —

The requirements are above the average. We'd like you to be between 35-45, and have qualities of real leadership. You'll have to be able to manage subordinates. You'll have to be sober, but a good mixer at the same time. Probably you'll have to be a college graduate, because the job demands technical education and experience. You will need to be thoroughly familiar with mechanical engineering, and have had practical experience with the problems of producing intricate precision machinery. You will have to know manufacturing methods and processes, and how to write operation sheets for metal-working industries. You must know production planning and scheduling and control systems, and how to set them up and administer them. You will need to have experience in modern personnel management, including job evaluation, merit rating, upgrading, foremanship training, and selectivity tests. You'll be required to compile and submit operating reports to top management.

IF YOU THINK YOU'RE THE MAN —

here's what to do: Sit down and write us all about yourself. Outline your education, training, and experience. Tell us why you think you can be a real general manager for our plant. Be sure to include a recent snapshot of yourself. We will treat all applications in confidence. If you are engaged in an essential industry now, remember that we need a statement of availability before we can actually engage you. Send your letter to P-682 Factory Management and Maintenance, 330 West 42nd St., New York 18, N. Y. Interviews will be arranged at our expense.

POSITIONS WANTED
(Continued from page 424)

INDUSTRIAL ENGINEER — Married—3B—14 years experience installing and administrating Wage Incentive plans. Individual and group. 12 years with large chemical company. Experience includes equipment, design, methods, time-study, wage incentives. Now Time-Study Supervisor. Desires executive or supervisory position with reputable large company engaged in War work which normally has basic peace-time business. Minimum salary $7000-$7500. PW-669. Factory Management & Maintenance, 520 N. Michigan Ave., Chicago 11, Ill.

PERSONNEL DIRECTOR—Industrial experience in Employment, Job Evaluation, Terminations, Aptitude Testing, Employee Publications, Man Rating, Labor-Management cooperation, Grievances. Age 35, married, draft exempt, Protestant, aggresive post-war company only, available reasonable notice, primarily interested in company desiring to establish scientific personnel. Locate anywhere. PW-684, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

PLANT MANAGER: Personnel Director: Seasoned executive; draft exempt; experienced stampings; screw machine products; castings; forgings. Personnel evaluation; morale survey; supplementary training; management-employee cooperation. PW-685, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

INDUSTRIAL ENGINEER—14 years experience in organization and planning, cost control, standard cost development, methods, layout, incentives and job evaluation. Desire change to more fully utilize experience and ability. 35 years old—married—2 children—draft classification 2-B expiring June 1944. Minimum salary salary $8000. PW-687, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER—Executive, Superintendent, Works Manager, Industrial Relations. Expert in handling workers. Available immediately. PW-688, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

PRODUCTION MANAGER or plant manager. Thoroughly familiar with modern production methods in precision machining, stampings, foundry, plastic and ceramic products. Age 40. More interested in permanency than salary. PW-689, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago 11, Ill.

PLANT MANAGER: Engineering graduate, now superintendent and with 15 years industrial engineering background seeking to manage plant employing 500 to 1000 whose wartime and post-war plans require smooth introduction of practical production and cost controls. Experienced from both line and staff end in incentive wage payment, cost reduction, budgetary control of expenses, product planning, coordination and control of development of new products. PW-686, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y

INDUSTRIAL ENGINEER — Graduate Engineer. State licensed age 47—25 years experience in field—married. Desires position as Chief Industrial Engineer with large concern or Production or Works Manager with medium sized company, war work acceptable but a well established peace time business must exist. Experience largely in Organization, Method or Process Engineering, Plant Layout, Planning and Scheduling, Budget and Standard Labor Cost Control, extensive Wage Work including policies, Job Evaluations, Merit Ratings, Incentive Plans, Time and Motion Studies. Experienced in dealings and contract negotiations with Organized Labor. Presently employed but not to full capabilities. Available immediately. PW-691, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER, 34, recent college organization and management training. Broad experience relative to good engineering practice. Can assume responsibility. PW-692, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

MASTER Mechanic—experienced in all Plant Maintenance problems. Power plants, Foundries and Machine preventive maintenance. Can handle large forces of varied trades. PW-690, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

EXECUTIVE—twenty years experience in engineering, production, operation in steel and allied industries. Available in near future for position of supervision of industrial operation or engineering executive. PW-697, Factory Management & Maintenance, 330 W. 42nd St., New York 18, N. Y.

REPRESENTATIVE WANTED

MANUFACTURER'S AGENT now selling machinery wanted by well established company whose industrial equipment has both present and postwar demand. Company is one of the leaders in its field. Price of equipment ranges from $300 to $7,000 and is sold to many kinds and types of industry, including aeronautical, railroads, diesel plants, fleet operators. Write for details. A number of territories are open. RW-696, Factoy Management & Maintenance, 520 N. Michigan Ave., Chicago 11, Ill.

WAGE INCENTIVES

HIGHER PRODUCTION—HIGHER WAGES LOWER COSTS

We are currently installing the NORRIS UNIT SYSTEM of wage incentives, cost and production control in a diversity of industries, including foundries, machine shops, miscellaneous metal trades, wire mills, paper products, textile plants, radio and electrical equipment, refineries, . . . covering almost every phase of war production.

We will gladly discuss our methods with you, without obligation on your part, either in person or by correspondence.

NORRIS & ELLIOTT, INC.
Member Association of Consulting Management Engineers
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This advertising service of 34 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fees protected by refund provision. Identity covered and present position protected. Send for details.
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MANUFACTURING EXECUTIVES and TECHNICAL MEN
Qualified men wanted for openings throughout the United States. Write for application, or submit experience record.
Inquiries solicited from responsible employers. All negotiations confidential. Est. 28 yrs.
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53 W. JACKSON CHICAGO

EXECUTIVES AND TECHNICAL MEN
Be Ready for Post War Opportunities
We solicit inquiries from qualified candidates who desire to contact employers for positions paying up to $20,000 per year. Confidential. Est. 29 years.
(Inquiries from Employers entail no obligation)
THE NATIONAL BUSINESS BOURSE
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Export to Great Britain
For those who wish to make arrangements now to satisfy post-war demands. Well established financially very sound London firm of Importers and Wholesale Distributors to the Grocery, Provision, Ironmongery, Hardware and Allied trades also Co-operative Societies whose 30 travellers cover every county of England, Scotland, Wales and Ireland is open to entertain serious offers from substantial manufacturing firms, Exporters and producers with a view to sole distribution. First class references available.
Write Box 358,
FREDK. ALDRIDGE, Ltd.
30, Bouverie St., London, E.C.4.

TRAINING PROGRAMS
MANUFACTURING METHODS
TIME AND MOTION STUDY
Better methods and lowering costs are a continuous occurrence when the entire supervisory organization has participated in our manufacturing methods training programs. Programs provide their Time Study Engineers with advanced technical training and Supervisors and Foremen with a knowledge of the principles of effective manufacturing methods.
For continuous cost reductions through training, write:
METHODS ENGINEERING COUNCIL
Wood & Franklin Sts., Pittsburgh (21) Pa.

Machinery Manufacturers Notice
We are interested in having built circular, cast iron pots 11 ft. in diameter with hollow bottom weighing 12,000 lbs. including stirring device. Reply to
CW-679, Factory Mgt. & Maintenance
330 W. 42nd St., New York 18, N. Y.

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A Product to Manufacture
Organization of several hundred skilled designers, engineers, and toolmakers, and a modern tool room seeks post war product or machine to tool. Complete facilities for development from tooling to sales and advertising.
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330 W. 42nd St., New York 18, N. Y.

J. L. HEMPHILL & CO. Inc.
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1600-1604 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2800

MOTOR GENERATOR SETS

1—6000 ampere, 6 volt, Hanson-VanWinkle
1—1500 ampere, 6 volt, Hanson-VanWinkle
1—750 KW, 250 volt, Allis-Chalmers, synchronous
1— 75 KW, 125 volt, G.E. sq. cg., 25 cycle
3— 10 KW, 250 volt, General Electric squirrel cage

TURBINES

1—600 KW, Terry, dual bleeder turbine only.
1—500 KW, General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—300 KW, 2300 volt, Westinghouse, non-condensing.
1—300 KW, 3 phase, 60 cycle, 220 volt, General Electric, condensing.
1—200 KW, General Electric, condensing.

TRANSFORMERS

3—400 KVA, General Electric, 4150-240/480 volts.
4—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000/2300 volts.
4—100 KVA, Westinghouse, 13,200-250 volts
3—100 KVA, General Electric 2200/220/110
3— 75 KVA, General Electric 2200-220/110
3— 75 KVA, G.E., 13,500/440 volts.
3— 50 KVA, General Electric, 2200/220/110 volts.
3— 50 KVA, Pittsburgh, 15,000/7500/110/220 volts.
3—37½ KVA, General Electric, 2400/240/120 volts.

MOTOR—3 PHASE, 60 CYCLE

No.	H.P.	R.P.M.	Volts	Type
1	400	514	440	West. Sl. Rg
1	350	300	440	G.E. Sl. Rg.
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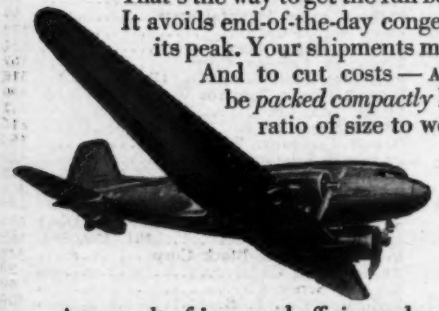

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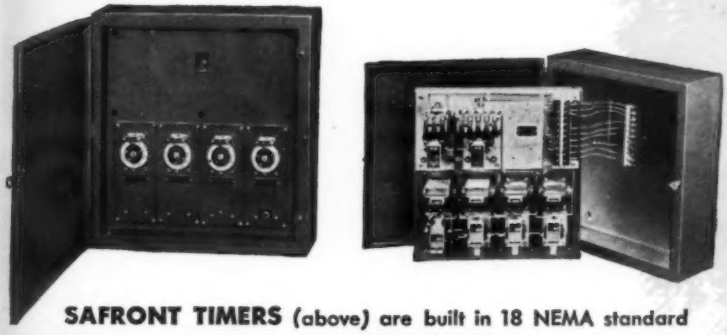
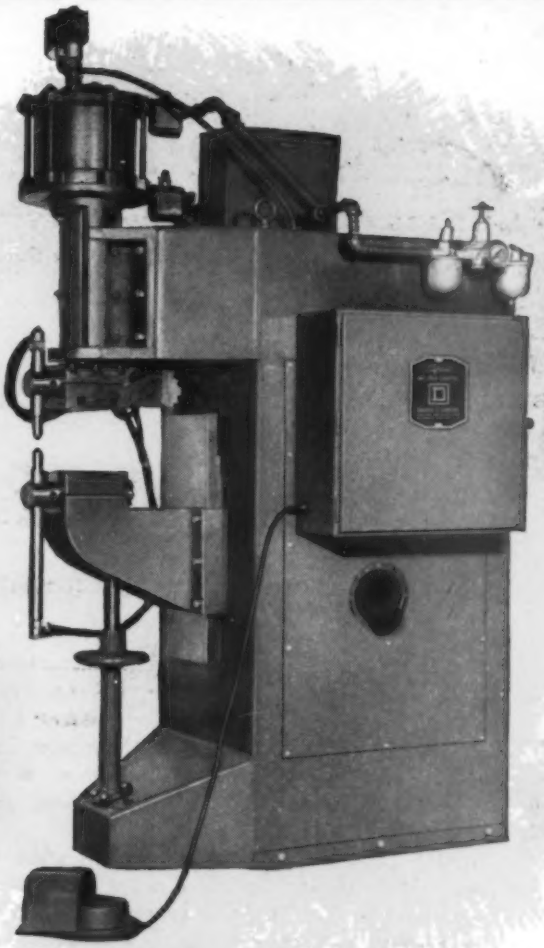
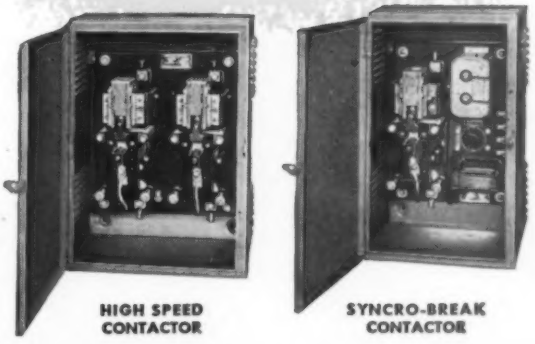


SAFRONT TIMERS (above) are built in 18 NEMA standard types. Notice, in upper left photo, how all electrically energized parts are behind a protective panel, yet calibrated timer adjustments are accessible on panel front. Separate timing devices, provided for each step of the welding cycle, are individually adjustable from 3 to 100 cycles. Safront interiors "swing out" (upper right photo) to expose operating parts.





HIGH SPEED CONTACTOR

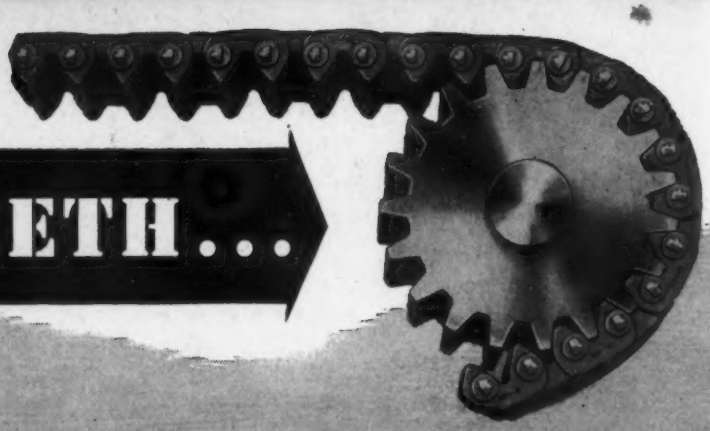
SYNCRO-BREAK CONTACTOR

HIGH SPEED AND SYNCRO-BREAK CONTACTORS (right) possess unusual design features necessary for frequent making and breaking of the welding transformer primary circuit. The Syncro-Break design includes means for opening circuit without arcing at contact tips, thus increasing contact life and allowable ratings.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



TEETH...

Teeth Not Tension

ARE IMPORTANT

1. Because they operate on the principle of "Teeth Not Tension" . . . Morse Chain Drives Cannot Slip, *Cannot Waste Power.*

2. Because they maintain an absolutely constant speed ratio . . . Morse Chain Drives *assure full capacity machine production.*

3. By transmitting an unvarying, constant flow of power . . . Morse Chain Drives *help work uniformity to be achieved.*

4. Longer-lived, requiring no tensional adjustments . . . Morse Chain Drives reduce replacement and maintenance work, *reduce "Down" time.*

5. Installed by slipping chain over pinions, inserting and securing the pin . . . Morse Chain Drives *eliminate the need for dismantling bearings or parts of the machine.*

6. Unaffected by atmospheric conditions, idleness, or oil . . . Morse Chain Drives *operate at peak efficiency under all conditions.*

7. Low in first cost and in maintenance cost, too . . . Morse Chain Drives *always cost less per year of efficient service.*

8. Easily adapted to speed changes, capable of saving valuable space because they operate efficiently on short centers . . . Morse Chain Drives, from an over-all standpoint, *are most efficient, most economical.*

SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *Roller and Silent* CHAINS

MORSE CHAIN COMPANY • ITHACA, N. Y. • DETROIT, MICH. • A BORG-WARNER INDUSTRY